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AVIATION AND COSMONAUTICS

No. 4, April 1983

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Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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SOVIET SPACE PROGRAM DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 1-2

[Article by Lt Gen Avn G. Beregovoy, chief, Cosmonaut Training Center imeni Yu. A. Gagarin, twice-awarded Hero of the Soviet Union, USSR pilot-cosmonaut: "The Path Into Orbit"]

[Text] Great is the contribution made by the Soviet Union to the world's development of outer space and the world's scientific-technical progress. The results of Soviet experiments in space are being used for the benefit of all mankind. The interests of science and production and the purely theoretical and applied problems troubling scientists, designers, engineers and representatives of the most diverse specialties have merged into a single unit in today's cosmonautics. Futher study and development of outer space in behalf of the development of science, technology and the national economy is one of the most important problems in the natural and technical sciences, upon the solution of which the efforts of the current five-year plan are being concentrated. This was reflected in documents of the 26th CPSU Congress.

The Soviet Union has created a powerful industry, a well organized industry, Soviet science has attained a high level, and in many areas it has assumed the leading place in the world. Behind all of this has stood, and now stands, the organizational effort the the Communist Party and the Soviet government.

More than 20 years ago the CPSU Central Committee and the USSR Council of Ministers approved scientific-technical and organizational measures to prepare for man's flight into space and for planned exploration and exploitation of outer space. The Cosmonaut Training Center came into being, to be subsequently named after Yuriy Alekseyevich Gagarin. The training center became the first space academy, and an international academy at that.

The difficulties and joys of the roads into space have become familiar to cosmonauts of fraternal countries participating in the international "Interkosmos" program and to the French cosmonaut Zhan-Lu Kret'yen [transliteration], and ambassadors from India are preparing for a flight. International flights into space have provided valuable material to scientists in countries of the socialist fraternity.

scientific research and experiments conducted by crews in orbit significantly expanded our knowledge on many natural phenomena, in the procedures of obtaining new materials and in developing original methods and apparatus for observing the environment.

Many sectors of the national economy are interested in information from outer space. It is needed by geologists and builders, fishermen and toilers of the fields, seamen and weathermen. Space--in the service of the national economy! Such is the main principle that is being practically embodied in the program of every experiment or observation made in orbit, irrespective of whether it is concerned with studying the natural resources of our planet or aimed at investigating the distant expanses of the Universe. Thus the results of observations made in orbit are used to arrive at logging volume predictions for certain regions, to protect the forests and so on, and to resolve the problems associated with sensible land use and with the construction of new cities and large transportation arteries. These meager facts conceal an enormous amount of work, and an effort to solve complex scientific, technical and organizational problems.

The training center is as old as manned cosmonautics, and within this short time it has traveled a long road. Twenty years ago, perhaps the main concern of the specialist was to prepare the cosmonaut's body for its encounter with the unusual environment. It was important to understand whether or not man would be capable of working at all in space as an operator. Therefore the main attention was devoted to preparing cosmonauts for work in weightlessness and in the presence of high accelerations. Pressure chambers, a centrifuge and a flying laboratory were used extensively for this purpose.

As our knowledge of outer space and its influences upon man increased, we improved our cosmonaut training methods and created new technical resources. As an example after it was revealed that blood tends to collect in the head of a cosmonaut in the period of his adaptation to weightlessness, new training methods using special devices were developed. And then, it was found that after a lengthy flight, the body has difficulty getting used to earth's gravity. Thus the specialists found ways to ease the return of cosmonauts to earth.

Now we know that cosmonauts can remain in orbit for months at a time. They can do more than just fly: They can also perform highly diverse, complex research. To do so, they must possess extensive knowledge in the most diverse areas of science and technology. This knowledge is acquired in the general space training phase, which is conducted in groups following a general program. In this period the individual features of the cosmonauts are studied, which is important to selecting future crews, inasmuch as mutual psychological compatibility must be accounted for as well.

Orbiting stations are scientific laboratories in which only those who are fully acquainted with their equipment and with the experimental procedures can work. Take as an example the space radio-telescope. It takes weeks to learn how to use it. And consider that there are dozens of instruments and devices aboard the station.

The research program that must be carried out by cosmonauts is meticulously worked out using models of the scientific apparatus. The creators of the experiments sometimes play the role of instructors. Cosmonauts improve their knowledge by serving apprenticeship in scientific institutions. Let me cite just one figure to demonstrate the scale of all of this work: Our center interacts with over 300 organizations--institutes, design bureaus, institutions of higher education and enterprises.

On occasion I have heard the opinion that it is easier and simpler to master the cosmonaut's profession today than in the era of the pioneers. Can we really agree with this? Hardly. Here is why. The requirements on a cosmonaut candidate have not gotten simpler; on the contrary, they have broadened, since the content of the profession has changed. Judge for yourself. Before, we devoted just a year to general space training, and now we are beginning to think that this period must be lengthened. The tasks that must be carried out in flight have grown improbably more complex as well.

Nonetheless, today's cosmonaut is more than just a researcher with a broad background. As before, he is also a pilot, an operator controlling space vehicles. He learns to do this in the second phase of the training--the space flight training phase. We do not have training spacecraft yet. This is a unique feature of our work that cannot be avoided. After a pilot finishes preparing himself in a trainer, he has the opportunity to fly in a training airplane. He is accompanied by an instructor who points out his mistakes and suggests how he can improve his actions. But a cosmonaut is sent out on a real flight right away.

I can say without exaggeration that every space flight begins back on earth. Cosmonauts first study theory, diagrams, mock-ups and operating models of all units in the spacecraft and station. Then they begin lessons in specialized trainers practicing each operation and entire phases of flight. And finally they go on to an integrated trainer in which the entire flight can be simulated from take-off to landing. Trainers are outfitted with computers simulating the behavior of onboard systems depending on the operator's commands. The trainer reacts to a cosmonaut's actions in the same way as would a real craft: Engines are turned on and shut down, and the view from the portholes changes. In a word, a complete illusion of movement in outer space is created.

But even such a trainer cannot provide an impression of some of the physical conditions, weightlessness for example. Flying laboratories acquaint us with the world of weightlessness. When an airplane flies a parabolic trajectory, people inside it experience the sensation of weightlessness for 20-25 seconds. That is not very much, but it is enough to provide an understanding of what it is like. An Il-6 flying laboratory is equipped with a system that picks off and records technical and medical information, and its cargo hold has a volume of about 400 cubic meters, enough to install training apparatus weighing up to 6 tons.

Lengthy operations to be conducted in weightlessness are practiced in a special swimming pool--a hydrolaboratory. Incidentally, our swimming pool, which has

diameter of 23 meters and a depth of 12 meters, is large enough to fit a "Salyut" station together with a docked transport craft. Cosmonauts in pressure suits having zero buoyancy at a depth of 3-5 meters can remain for hours in conditions close to those of referenceless space.

Centrifuges are used to train cosmonauts as well as to prepare for their first flights into space. The training program also includes flights aboard airplanes and parachute jumps. There were of course some who were against flight training. Things were not even clear to those who were for it. What sort of airplanes should they fly? How many flying hours should they clock in each phase? What habits should they develop, and which could be excluded? Fundamental research had to be carried out before these questions could be answered. Aircraft flights and parachute jumps helped to shape the professional qualities of an operator in cosmonauts: fast thinking, emotional stability, psychological preparedness to act in complex flying conditions, the capability for enduring the influence of space flight factors etc.

A planetarium was designed with the help of specialists from the GDR and placed into operation in order to permit study of space navigation and refinement of the procedures of scientific research involving the use of celestial bodies. It reproduces about 900 stars and constellations, and the motion of the Sun, the Moon and the planets.

The center's instructors prepare cosmonauts for all surprises. After all, it only seems as if trips into outer space have become routine. For example, could anyone have foreseen that in the concluding phase of B. Lyakhov's and V. Ryumin's flight the openwork antenna of the radio-telescope would not separate from the station right away? Hardly.

During training, the instructors constantly place the space researchers in complex unusual situations. Before going on a flight, a crew goes through hundreds of them. It is entirely natural that they get used to acting confidently in unforeseen circumstances.

But now the complex flight program, which has been going on for many months, comes to an end. The cosmonaut must return to earth healthy and alert. And for this, he must regularly perform purposeful physical exercises during his flight. The experience of six lengthy expeditions aboard the "Salyut-6" and "Salyut-7" orbiting stations showed that if crewmembers conscientiously follow the prescribed program, their return to the world of gravity is easier. Sometimes it is hard to force oneself to do physical exercises, even if you are sure that they are necessary. Imagine a cosmonaut turning the pedals of a bicycle ergometer for a long period of time without moving foreward, literally to exhaustion. He must ride the ergometer or run a treadmill and exercise with expanders for 2-2.5 hours daily. This is not so much sport as it is real work. One must be a very willful person to live such a strict regimen for months. This is why we do more than just devote considerable attention to physical exercises: We also try to prepare the crew psychologically for the rigorous conditions inside a spacecraft.

In short, it has now become simultaneously easier and more difficult to prepare a crew for flight. It has become easier because we now know a great deal about space and we possess modern equipment and improved training methods. It has become more difficult because the space programs have grown incomparably more complex. The crewmembers must be physically and psychologically prepared for work in unusual conditions, they must have a faultless knowledge of space technology, and they must be outstanding pilots and competent researchers. It is specialists such as these, ones capable of performing important assignments of the motherland, that the center prepares.

Space research makes up an organic part of our national economic plans. Cosmonauts launched into near-earth orbit know that they are called upon to work in behalf of the joyous future of the Soviet people and all mankind. They are honorably serving their labor watch, displaying courage, endurance and proficiency. An example of this is the 211-day flight by Soviet cosmonauts A. Berezovoy and V. Lebedev, the longest yet. They made a great contribution to fulfilling the decisions of the 26th CPSU Congress on peaceful development of outer space in the interests of developing science and the country's national economy.

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SPACE FLIGHT SIMULATORS, TRAINERS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) p 3

[Article by candidates of technical sciences I. Pochkayev and V. Grigorenko: "Training Base"]

[Text] A scientifically grounded training system satisfying the requirements of today and of future tasks has now evolved at the Cosmonaut Training Center imeni Yu. A. Gagarin. Its material foundation consists of a continually developing training base. It now includes integrated and specialized trainers, testing units and devices that simulate the conditions of space flight.

Integrated trainers for transport craft and orbiting stations make it possible to successively practice all phases of space flight. The following basic operations are rehearsed the most carefully in this case: orbit insertion; flight in orbit aboard a manned spacecraft oriented on the Sun, the earth, ground reference points, the stars and planets; navigation of the manned spacecraft using objects in space; maneuvering in orbit; search, approach and docking with other spacecraft; undocking and descent from orbit.

Naturally hundreds and sometimes even thousands of ground training sessions are needed to form stable habits. This requires great effort on the part of both the cosmonauts and the engineering staff participating in the training. After all, the work of many collectives could be reduced to naught if this effort were not made.

As with the development of space, development of space trainer building proceeded on an untraveled road, and an enormous effort was needed for every new achievement. Thus the first trainer for the "Vostok" spacecraft, which is now on exhibit at the Museum imeni L. I. Brezhnev in the town of Zvezdnyy, was a full-sized training mock-up.

Later on, trainers in which dynamic operations involving a cosmonaut could be practiced were designed for the "Voskhod" and "Soyuz" spacecraft. The trainers of this generation were fully self-contained in terms of the composition of their devices.

As a rule each of them had five independent functional blocks--a mock-up of the manned spacecraft, a computer system, a mating device, a system simulating

the visual situation and the instructor's console. Their main shortcoming was their rigid, almost unmodifiable structure. Therefore when certain modifications were made in flying models, the trainers had to be rebuilt.

Looking back from today, we can only imagine the sort of organizational and technical difficulties that had to be surmounted by the designers and operators who had to rebuild the trainers. After all, even within the limits of a single series, each manned spacecraft differed from its predecessors.

Further development of space technology, growth in the complexity of tasks assigned to the crews and their broader participation in space experiments significantly raised the requirements on trainers. The role of not only the technical but also the economic and organizational aspects of their creation grew. After all, each of them is a unique one-of-a-kind technical complex. In a number of cases trainers are more complex than the real equipment.

As the development of space trainer building continued, the need for creating a training complex arose. This conclusion was made on the basis of the results of a number of scientific investigations conducted at the Cosmonaut Training Center imeni Yu. A. Gagarin jointly with industrial enterprises. Creation of a trainer complex would permit integration of the main trainer systems, and it would make it possible to alter their work program flexibly. This approach became possible with the broad use of modern digital computer technology.

The structure of the training complex also includes five basic blocks. In this case each of them, except for the mock-up of the manned spacecraft, is used on a shared basis. The only thing that is unique to each block is the given mock-up of a concrete manned spacecraft.

It stands to reason that the number of trainers that are "brought together" by a specific program and which can function simultaneously depends on the possibilities of the blocks of the training complex. It is based on a computer system created out of modern computers. It can stimulate the systems of different spacecraft, and at the same time retune the blocks of the trainer complex to permit "assembly" of concrete trainers.

The mating devices are digital-to-analogue, analogue-to-digital or other forms of converters. They make all of the systems of the training complex compatible in terms of information and signals.

The blocks that simulate the visual situation are the most expensive, the most complex and the most difficult to manufacture. Their basic units (modules)--space optical observation resources--are narrowly specialized. Use of the modular principle makes it possible to create a single flexibly adjustable system that simulates a visual situation in accordance with a digital computer program. And in the future, they will be unified through the use of optical television and computer methods of forming visual images.

Basically the same can be said for instructor consoles as well. Based on graphic displays, they are becoming resources that are used on a shared basis,

and for a given period of training, they are included in the composition of any one of the "assembled" trainers. This makes it possible to reduce the number of individual instructor consoles.

The transition to a trainer complex based on integration of the principal devices is making it possible to utilize the complex's resources more fully, to reduce the time it takes to manufacture trainers for modified manned spacecraft and to reduce the economic outlays on technical cosmonaut training resources.

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NEWLY COMMISSIONED LIEUTENANTS REPORT FOR DUTY, TRAINING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 4-5

[Article by Lt Col N. Tregubov, military pilot 1st class: "The Lieutenants are Working Themselves In"]

[Text] School is out. The ceremonies of awarding officer shoulderboards and diplomas and the graduation night are behind. And now the train carries the lieutenants to their new place of service. They recall the parting words of their commanders and instructors, and the parting wishes of friends assigned to other units. The promises of these lieutenants to be forever faithful to old buddies and their touching naivete are still fresh in their minds, as is their sincere dream of getting together some day in the same unit, in the same squadron and never parting again.

But questions of another sort trouble them most of all: How will their subsequent life take shape, which airplane will they fly, what is it like to live in the part of the country in which they will serve and, finally, what are the people like in the regiment, what sort of welcome will they give? Yes, only he who had been in this position himself can understand what was transpiring in the young pilot's soul.

The young officers are traveling to their line units, full of inexhaustible energy and creativity. But what is happening meanwhile in the places to which the young people have been assigned? I can confidently say that the commanders, political workers and future fellow servicemen are just as anxious, that they are trying to prepare everything necessary to help them join the ranks of the winged defenders.

The graduates obtained the necessary volume of knowledge and the initial flight skills in the aviation schools. Now the lieutenants must undergo complex phases of combat training in the regiment, one which will become both their home and their school of combat maturity for many long years.

The development of pilots as air warriors depends to a great degree on the atmosphere in which they take their first steps. Creating favorable conditions for working them in as quickly as possible is the task the commanders, the political section and the party and Komsomol organization of our unit are

working on untiringly. And so they must: After all, the young people are our replacements, our hope, our future.

Each year new lieutenants arrive in our unit, and each year we prepare to greet them. We try to create conditions in which they would sense attention and a benevolent attitude from their very first days of service, one in which they could immediately begin combat training. This is not easy to do. After all, the people that arrive are different, their characters, traits, concerns and needs differ. The appropriate key must be found for each one of them, the needs of each must be clarified, and each must be helped in surmounting the arising difficulties.

We begin preparing to greet the young complement as soon as we get the personal files. They are studied and discussed, and then the officers are distributed among the squadrons, flights and crews. Theoretical and flight training plans are drawn up for them. The commanders and political workers try to reveal beforehand what the young officers may need when they arrive at the unit, and they take steps beforehand to make sure that they would have the fewest problems to deal with.

A little more than a year passed before the officers--graduates of a higher military aviation school for pilots--arrived at our unit. We had learned previously from their personal files that they were all sensible fellows with a boundless love for the sky. Two graduated from school with a gold medal, and two graduated with honors. And the opinion of the commanders and political workers who acquainted themselves with the personal files of the lieutenants was unanimous: They won't let us down!

Finally, they arrived. Calm, serious Anatoliy Zaytsev, somewhat phlegmatic Sergey Gaponov, deep-thinking Sergey Pelikh and Vyacheslav Shakhov, bright Igor' Sulim, and somewhat shy Sergey Pinigin. They stood there smiling with embarrassment, sensing the friendliness of the atmosphere and the benevolence, but unable to surmount the uneasiness of being the center of attention. After talking with the command, on that same day they were sent to the squadron commanded by Lieutenant Colonel V. Zuzlov, distributed among the flights and introduced to their new commanders. Then they got to know their new fellow servicemen, the history of the unit and the tasks facing the personnel in the training year. And soon the lieutenants began performing their official responsibilities.

Addressing the task of strengthening the country's defense capabilities, the party and government base themselves on Lenin's premise that the main and decisive force in war is people indoctrinated in the spirit of selfless devotion to the ideals of communism and the socialist motherland, and having outstanding mastery of military equipment and weapons. Fulfilling the requirements of maintaining high combat readiness, we try to create conditions for recent school graduates in which they could work themselves into the ranks of the defenders of the motherland's air borders in the shortest possible time. Planning this work, the command bases itself primarily on the directives of the air force commander in chief, as spelled out in the year's guidelines on training young flight crews.

Working up the combat training plan for the training year, we considered the possibilities of the airmen and their professional maturity. This made it possible to create a purposeful program of assimilating a fighter-bomber new to them, and preparing them for examinations for 3d class.

Experienced commanders and instructors like squadron commander V. Zuzlov, his deputy Major A. Osipov and flight commanders captains I. Sinitsa and V. Tashtamyshev took on the job of training the lieutenants. They played the decisive role in the development of the young air warriors.

Officers Sinitsa and Tashtamyshev are good instructors, thoughtful indoctrinators and competent pilots that are excellently trained in professional respects; they offer an example of conscientious service, diligence and discipline. They meticulously impart to their subordinates the conviction that there can be no inconsequential things in aviation, that careful, persistent preparation for a flight is guarantee of its success. The instructors managed to organize the work in such a way that the recent school graduates, who measured themselves up against their commanders, attained high results relatively quickly. And the secret lies in the fact that they deeply studied the personal and working qualities of their subordinates, so that they could develop their initiative, boldness and creativity competently and purposefully, and teach them to live and work with an eye on the future.

Striving to get the young officers through all of the forms of flight training in the shortest possible time, the commanders never forget about flight safety for even a minute. They do everything necessary to exclude violations of the rules of flying, and they do not allow undertrained pilots in the air.

Ways to improve the methods of training young officers are often discussed at executive conferences. The unit's instruction methods council has developed concrete recommendations for the instructors on predicting and preventing typical errors. A plan of additional lessons in aerodynamics and navigator training and for studying instructions and other flying guidelines was written.

The issue of acquainting the personnel with aviation equipment they had not used before was discussed at party and Komsomol meetings of the air squadrons. Communists and Komsomol members suggested many proposals for improving the quality and reducing the time of training young pilots in the complex forms of combat training. The party organization placed under its control the training of the young officers and the daily, weekly, monthly and annual progress each airman was making in improving his proficiency. The political workers and active party members often talk with the lieutenants, and they attentively follow their successes and failures. The airmen that are party candidates and members are periodically allowed to speak at bureau meetings. Special attention is turned to the quality of their training, to their psychological morale during flying, and to their knowledge of the order and sequence of fulfilling a given flight assignment and of actions to be taken in unusual situations.

The efforts of the commanders, political workers and instructors were not unsuccessful. It was felt from the very first flight that the young pilots were

confidently mastering the equipment, and that they were trying to get the maximum benefits for themselves from every flight. They all began flying solo after a minimum training program. Owing to their persistence, lieutenants Zaytsev, Sulim and Pelikh achieved stable results in training flights.

It is said that if you start successfully, you are half way there. But full mastery of aviation equipment requires prolonged, hard work. Only time could tell how well prepared the young officers are for this work.

The days and weeks passed, filled with complex and meticulous work in the classrooms and at the airfield. The period of getting on one's feet and proving oneself is a difficult time. It was not easy for the pilots, but then, there were many things they had to assimilate for the first time. However, they confidently learned the secrets of professional mastery.

The unit's command and its political section attentively followed the development of the young officers. They rewarded their successes, they meticulously analyzed the failures, and they developed the appropriate measures. Lieutenants Zaytsev, Pelikh, Gaponov and Pinigin, who had persistenly mastered the profession of military pilot, found themselves named more and more frequently among the leaders of the socialist competition and the best pilots of the unit.

Naturally, not everything went smoothly. The training process is thorny and hard. Complex problems over which the commander and the staff officers had to ponder often arose. We encountered one such problem during work on group flying. Some pilots lost their leaders as they went in or out of vertical maneuvers. Fearing reproach, they attempted to quietly locate the airplane of the leader and get back into formation. This is far from a safe thing to do. The commanders demanded that followers immediately report the loss of the lead pilot by radio, indicating their course and altitude. The command post could then help them form back up. Owing to the adopted measures the airmen soon learned to perform complex group flights successfully.

There were the inevitable disappointing mistakes in piloting technique as well. Thus on one occasion Lieutenant Pinigin applied his brakes incompetently during a landing run, and the airplane rolled off the end of the runway. And Lieutenant Sulim attempted to land without setting his wings in landing configuration. All of the errors were meticulously analyzed.

When the training year ended, the regimental command noted with satisfaction that all young pilots had completed the course of assimilation of the new aviation equipment, fulfilled the flight training program and passed the examination for military pilot 3d class. But the main thing is that they had developed into officers, into air warriors. Now lieutenants Pelikh, Zaytsev and Pinigin are among the best soldiers of our unit. They set the example of perfoming party and official duty. Through their stubbornness and persistence in training, these officers gained the respect of the squadron and regiment; they are referred to as diligent, disciplined, resourceful pilots. Their strong and confident development was promoted primarily by strict compliance with the documents that regulate flying.

It is a joy to realize that a competent, steadfast, willful generation is replacing the older airmen. And the unit command and political section are confident that the young can be boldly relied upon in a difficult moment. They will not let us down!

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PSYCHOLOGICAL SKILLS, ABILITIES FOR FLYING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 6-7

[Article by Lt Col (Res) V. Dokuchayev, military pilot-sniper: "An Important Training Resource"]

[Text] The article "Into the Air By Way of a Trainer" (AVIATSIYA I KOSMONAVTIKA, No 6, 1982) compelled me to pick up a pen. Not because it said something wrong. I simply want to express my opinion about the place of trainers in the flight training system. The authors of the article, Lieutenant Colonel of Medical Service E. Kozlovskiy and Captain of Medical Service L. Drach, broke down the psychophysiology of flying into two components, habits and skills.

Basing myself on the most elementary findings of aviation medicine and my own flying experience, I dare to assert that for a pilot, the main habits are perceiving information and distributing and switching attention. They take long to form, and it is not easy to regain these habits after prolonged interruptions in flying. Let me try to show this with the example of one of the critical forms of flying activity--assimilation of new aviation equipment. Incidentally, I believe the term "retraining" to be incorrect, as I will show a little later.

The order of making a first flight aboard a new airplane is established by a program and instruction guidelines that are closely tied in with the training given to the pilot, and by other guidelines regulating flying in the given region. This is true of the first solo flight as well. The instruction guidelines clearly state the actions of the pilot in the first person. For example, "I pull the control stick all the way toward myself," "I turn on the automatic lock-on and tracking radar," or the "Supply tank pump," "I press the 'Stabilization' button," and the like. Indefinite statements such as "We turn on the afterburner," "You need to set the 'Wheel Cooling' switch" in "automatic" position are not permitted. This is quite right, since even the slightest possibility of arbitrary actions would thus be excluded. The pilot memorizes all instructions from the moment he enters the cockpit to the moment he leaves it.

But this is not enough. The instructor offers a thorough, descriptive explanation of the behavior of the airplane in all phases of flight, under different operating conditions and in response to change in flying configuration.

Thus a pilot assimilating an airplane new to him acquires habits that differ in many ways from those which he had when he flew his previous craft.

The pilot improves his habits by training in the cockpit. He mentally rehearses the flight several times, so that he could act freely and without mistakes, without using a crib sheet. When he finishes, he tests himself. Thus the mental model of the flight he has created allows him to fulfill his assignments with high quality and without an instructor's interference.

The pilot prepares for each new form of training in the same way. It would not be difficult to note that this means of colossal amount of work; moreover, before he flies, he must work out the actions he would take in extraordinary situations, of which there are many. This is where a trainer is a most effective training resource. Unfortunately, not all pilots have learned to simulate a flight; they do not have enough will, persistence and imagination to mentally create an image of a flight. And in any case, a trainer would exclude the possibility that an undertrained pilot would take to the sky.

The process of regaining lost habits has its unique features. Some pilots mistakenly believe that motor habits can be regained more easily while in flight, for example in a check-out flight. But following an interruption in flying, not all forms of training can work. Moreover, experience has shown that the habits of perceiving the situation and of distributing and switching the attention are the first to break down. Subjectively, the pilot may not notice this, and if he does not mentally rehearse his flight, he may wind up in a bad spot if the situation suddenly grows more complex. Finally, everything is aggravated by nervous and emotional tension. Commanders who do not understand this are later amazed when an experienced pilot is guilty of a near-accident.

Moreover the opinion exists that attention distribution supposedly means successive control of piloting and navigation instruments while flying in complex conditions. In fact, however, it entails an extremely vast complex of a pilot's actions that help him to keep his orientation, to maintain the necessary flying conditions, to control the work of the propulsion unit, to seek targets and in the final analysis, to fly safely. There is no doubt that a trainer makes it possible to work out many elements of this complex quickly and with high quality.

The question of the role of the pilot's notebook naturally comes up here: What does he need a notebook for? The relationship, we find, is a quite direct one. Preparing for a flight, the pilot uses it to record information from oral and from hard-to-get sources, and he uses it to make calculations and any notes he might need. All of this helps him shape intellectual habits and an image of the forthcoming assignment. Though of course, mechanical and I would say thoughtless transcription of instructions and redrawing diagrams of previous exercises does not provide anything useful. It is all just a useless waste of time.

Going through the motions of preparing for a flight is self-deception. In the air, the pilot uses information that he has in his head. When he takes off,

the pilot takes along short notes that he writes down in such a way that by quickly glancing at them he can instantaneously remember what he had worked out on the ground. A pilot's readiness for a flight can also be evaluated objectively on the basis of how completely he can relate the planned assignment. Once again the trainer is the best testing resource, especially when the person undergoing testing is given specific inputs. This would be a good place to think about using an audio monitoring device with the trainer. And of course, common sense should be the guide: We should not go overboard with all of this.

Prior to reading the article "Into the Air By Way of a Trainer" I believed that motor habits never break down. But if specialists have in fact established that this is possible following prolonged interruptions, then this is another argument in favor of the benefit a trainer can provide. I would like to say something in passing about the force it takes to move the trainer's controls, which is inconsistent with the feel of real controls. I think that this shortcoming of the trainers is insignificant, since a pilot measures his movements of the controls not in centimeters and kilograms but in relation to the airplane's response. Thus the individual quickly adapts to control in a real situation, and apprehensions that bad habits may be developed are groundless. In my opinion there is nothing in common between a dynamic stereotype and the motions used in control of an aircraft. And if habit transfer is sometimes brought up, I think that it is simply a way of excusing unsatisfactory training without taking the trouble to search for the true cause of the mistake. This is precisely why the term "retraining," which presupposes annihilation of old habits and acquisition of new ones, is essentially incorrect.

Habits are not lost when a pilot assimilates a new airplane; instead, they are expanded and improved. And of course, it would be unsuitable to keep the operating conditions of a trainer the same over a long period of time. The fact is that different airplanes of the same type have their unique features (some are "light," some are "sluggish"). Even aboard the same aircraft, the play of the controls also varies under different operating conditions and in different phases of flight--while landing for example. The reason for this lies in the configuration of the aircraft, the sort of gear suspended from the wings, the amount of fuel remaining, the air temperature, atmospheric pressure, wind speed and direction, and other factors. Thus in each case the movements are never the same, never exactly the way they are learned. It has been noted in this regard that the best pilots are those who have fully assimilated their airplane and who fly two or more types of aircraft in parallel.

The aircraft commander candidates brought up by the authors as an example in the article show that while they had clocked a considerable amount of flying time and they exhibited sound motor habits while flying under the sure guidance of a commander, these pilots were found to be untrained in leading a crew, in making independent decisions and in acting calmly and competently in a complex situation. And it was a good thing that the trainer persuaded them of this.

Let me say frankly that every pilot experiences nervous and emotional tension in a complex situation. But the better his occupational training

and the better he develops his habits, the sounder is his emotional stability. Even when a situation suddenly becomes complex, such a pilot is not knocked off balance. All components of habits are closely interrelated, and they form in integration. This is why a trainer is a highly effective means of developing and maintaining them. It may be said categorically that "flights" aboard a trainer are the main form of pilot training, and that they do not have even the slightest unfavorable influence.

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PARTY WORK USED TO RAISE TRAINING EFFICIENCY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 8-9

[Article by Col G. Galyashkin: "An Indicator of a Communist's Maturity"]

> [Text] "We will always be invariably faithful to Lenin's norms and principles, which have established themselves so firmly in the life of the party and state."
>
> From a speech by CPSU Central Committee general secretary, Comrade Yu. V. Andropov at the November (1982) CPSU Central Committee Plenum

There was a time when the air squadron presently commanded by Guards Major P. Portyanov began noticeably sliding from the position it had taken in the socialist competition. As a result it was unable to reconfirm its outstanding title. Having deeply and attentively analyzed the state of affairs in the subunit, the unit command and the party committee concluded that the failure was not accidental. As it turned out, some communists--pilots and technicians--had lowered their self-exactingness, and they began lessening their attention to indoctrination of the personnel. It was evident that the glory of the leading squadron, which had been ahead of all others in the competition for a long period of time, caused the people to relax. This in turn led to deviation of the collective from Lenin's norms of party life.

This conclusion was a rather serious one, but for the sake of justice I should note that the command and the communists did evaluate the situation self-critically and in a business-like manner. The squadron commander, the political worker and the secretary of the party organization were invited to a party committee meeting that was held soon after. These individuals were strictly punished for their neglect of the combat training and ideological and political indoctrination of the airmen. The criticism was acute and principled, but at the same time it was constructive. Assessing their strengths, the active party members determined the ways of eliminating everything that kept airman training from being effective, and they planned concrete measures aimed at making every party member and candidate contribute honorably to the cause of strengthening combat readiness and discipline and to establishing a healthy moral climate in the collective.

The squadron's communists also made the appropriate conclusions for themselves. They responded properly to the party's exactingness and the strictness of its assessments, and they rose above of personal insult. Energetically, without wavering, they took on the job of eliminating the shortcomings and omissions in ideological indoctrination of the personnel.

A little time passed. Gradually the subunit once again attained its leading position in the competition. Concurrently the flying proficiency and aerial skills of the airmen improved, and combat readiness was consolidated. Let me cite just one fact: The subunit became a squadron of masters of combat application. Now all pilots are in the top qualification class.

I bring this up to demonstrate how effective party criticism and self-criticism--one of the most important norms of party life--is to developing the creativity, initiative and diligence of communists and to fighting shortcomings. Developing healthy criticism and self-criticism creatively and in a business-like manner, party organizations consequently raise the importance of the party member even higher and encourage communists to participate more actively in the struggle to raise combat readiness, to strengthen military discipline, to unify collectives and to create an atmosphere of adherence to principles and comradely mutual assistance within them.

Life teaches us that party influence upon the airmen and upon their combat training is stronger and the social and political activity of the party members and candidates is higher in those party collectives that have created an atmosphere of higher responsibility and mutual exactingness, and which possess all of the conditions for direct and open criticism of shortcomings. As a rule the soil in which indifference and self-relaxation grow is absent from such subunits, the results of combat and political training are higher, and discipline and military order are stronger.

For example the personnel of the outstanding air regiment commanded by Guards Colonel S. Maystrenko honorably fulfilled its sizable socialist pledges in honor of the 60th anniversary of the USSR. The communists deserve great credit for the achievements of the airmen. They always evaluate their labor self-critically, and they strictly punish comrades in the party for neglect in combat training. The tone is set by the secretary of the party committee and a participant of the 6th All-Army Conference of Primary Party Organization Secretaries, Guards Lieutenant Colonel I. Zharikov. Under his charge, the party committee efficiently organizes implementation of the plans and proposals of the communists, and it persistently eliminates shortcomings.

The concern of the regiment's command and party committee for developing healthy criticism and their tactful and attentive relationship toward the remarks and proposals of party candidates and members have become the norm. The results: The regiment has managed to reduce the time it takes to make the subunits combat ready, and it has established strict military order.

But unfortunately things are not like this everywhere. We still encounter certain communist-leaders who admit to the value of criticism in their words

but understate it in their actions or completely ignore it. What negative consequences this may lead to may be seen from the example of Communist Major V. Popov, who serves in a separate airfield technical maintenance battalion. It should be noted that the area of work for which he is responsible is important. Since this is so, one would thing that the communist-leader's attitude toward his work would have to be rather serious and responsible. But this is not so.

Once Officer V. Popov was late reporting the readiness of the airfield for flying. The problem was subjected to analysis. It was revealed that on that day, he had never visited the runway or the taxiways, and he had not made sure that they were ready for operation. Moreover Popov did not even check to see how well the soldiers of the airfield service company were working. To make matters worse, there had been complaints against this person as a communist before as well. The officer did not always heed the opinions of people, and he did not participate enough in their ideological indoctrination.

Popov was made aware of all of this at a meeting of the party bureau. However, the communist-leader reacted quite uniquely to the principled criticism. Rather than heeding the opinion of the communists he assumed the posture of being unjustly slighted, of an insulted individual, and he stated some unjustified reproaches in regard to members of the party bureau. Nor did he alter his attitude toward the service and toward fulfillment of his military duty. The communists were compelled to subject Popov to strict party punishment. The command decided to appoint him to another position.

One unwittingly asks the following question: Is such an attitude toward valid comradely criticism in keeping with party membership? Popov's feeling of being insulted, which had no grounds whatsoever, and his attempt at getting even with other people for the criticism only did damage to the common cause of raising combat readiness and strengthening military discipline and order in the collective.

We know that party meetings are the best place for free exchange of opinions and for comprehensive development of healthy criticism and self-criticism. The Communist Party has always attached and continues to attach great significance to this important norm of party life, to strict compliance with the party charter. It is no accident that the 26th CPSU Congress emphasized that the party meeting is the place where all vital issues must be deeply and seriously discussed. It should be noted that many meetings of the communists in the air subunits and units of the air forces of the Group of Soviet Forces in Germany proceed at a high ideological and organizational level. They are typified by a business-like nature, bold statement of problems and critical analysis of positive experience and shortcomings.

But at the same time we should admit that some meetings are not yet being organized at the required level, and that they are conducted without active discussion of the posed issues. It is entirely understandable that such a situation encourages communists to remain silent at meetings and not state their opinions. Sometimes it happens that a person talks about negative facts but fails to name the guilty and analyze the reasons behind their improper

behavior. This usually happens where communists have not developed an interested attitude toward the affairs of their subunit and unit, where the people have not learned to speak frankly with each other.

The many years of party-political work in the group eloquently attest to the fact that the level of criticism and self-criticism is directly dependent on how well surveillance is maintained in the party organizations over the work done in response to remarks and proposals suggested by communists at party committee and bureau meetings. The correctness with which communist-leaders relate to the opinions of party comrades locally also plays an important role. A party approach to criticism is an indication of the communist's maturity, of his understanding of his personal responsibility to the party and Soviet state for strengthening the motherland's defense capabilities and the fighting power of the armed forces.

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KOMSOMOL USED TO RAISE TECHNICAL EFFICIENCY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 10-11

[Article by Maj V. Kovalev, deputy chief, political section for Komsomol work, delegate, 19th Komsomol Congress: "For Good Mastery of Equipment"]

[Text] The pace of the tactical flying exercise grew faster. The warplanes climbed into the sky one after the other. The fighter piloted by military pilot 1st class Guards Senior Lieutenant A. Drozd, the secretary of the squadron's Komsomol bureau, taxied out for take-off. In a few seconds the airplane took off, climbed swiftly and assumed its required course. The pilot had been given the mission of annihilating the "enemy" at the far approaches to the defended objective. Fulfilling the commands of the combat control officers, he acted confidently and efficiently, and he came on his target precisely.

It was not easy for the air warrior, but he won the duel with the "enemy," launching a training missile from the prescribed place. The assignment was completed with an outstanding score.

Many young communists and Komsomol members distinguished themselves that day: pilots Guards senior lieutenants A. Tokar' and S. Korobochka, technicians Guards senior lieutenants of technical service V. Tverdokhleb and A. Kiznev, and mechanics Guards Warrant Officer A. But'ko and Guards Private S. Valyayev. They acted resourcefully and competently, and they made their contribution to fulfillment of the high pledges adopted by the unit's personnel in the socialist competition under the motto "Raise alertness, dependably insure the motherland's safety!".

Success did not come right away to this young collective. Serious, meticulous, hard work was required of the commander, the political worker, the party organization, the active party members and every Komsomol member. As an example things did not all go well at first with the young pilot S. Khodak and some of his peers. The regimental command, the party committee and the Komsomol committee did a great deal to work them into the unit. The squadron made an effort to see that the training material and equipment base would be improved, that some of the classrooms would be reequipped and that new diagrams and mock-ups would be manufactured; lessons were started in technical knowledge circles led by experienced engineers. All of this produced positive results.

Today Guards Senior Lieutenant S. Khodak is an expert air warrior and a military pilot 2d class. The Komsomol organization has recommended him for CPSU candidacy.

The following fact attests to the principled approach of the Komsomol members and their preparedness to come to the aid of a comrade. One day, Private N. Chekhlatov was assigned to the subunit, in which he assumed the post of aircraft mechanic. He did not distinguish himself in any special way in his first days. He did his work reluctantly, and he did not try to raise his occupational proficiency and technical competency. The active Komsomol members could not condone such an attitude. The Komsomol bureau secretary talked with Chekhlatov. The soldier was criticized at the next meeting. Sometime later, the private gave a report on his progress on improving his knowledge and habits at a meeting of the Komsomol bureau. All of this had its effect. The specialist fundamentally altered his attitude toward Komsomol and official duty. Recently he successfully completed his test for 2d class.

We have many such viable Komsomol organizations. Following the example of the leaders, in the new training year the young airmen are persistently improving their occupational proficiency, they are attaining significant successes in combat training, they are meticulously absorbing the experience of senior comrades and communists, and they are learning purposefulness and persistance from them.

Implementing the decisions of the 19th Komsomol Congress is believed to be the main task today, a matter of honor by each Komsomol member. The Komsomol committees and bureaus are showing untiring concern for continually improving the general educational and occupational knowledge of the young soldiers and for setting a personal example in the mastery of modern weapons and combat equipment.

Fulfilling the decisions of the 19th Komsomol Congress, many young military collectives have taken confident strides forward in combat improvement. The Komsomol organizations in which Guards captains S. Miroshnichenko and V. Bulanov, captains V. Mal'tsev and N. Podol'khovyy and senior lieutenants V. Kochetkov and D. Shul'tsev are serving are in the lead. In these organizations, all of the young airmen have actively joined the movement "Komsomol concern for modern aviation complexes!". The Komsomol committees and bureaus are successfully implementing the long-range plan for raising the technical and special knowledge of the airmen.

The Komsomol military-technical examination "In Behalf of Knowledge, Proficiency and Work Effectiveness," which came into being on the initiative of the Komsomol members of one of the leading air regiments, is promoting completion of the tasks at hand in many ways. This form of competition between subunit Komsomol organizations has proven itself well. It emphasizes the quality of preparing equipment for flying, the number of equipment failures and malfunctions detected, the professional competency of the young specialists, their participation in efficiency work and in publicizing the best experience, and demonstration of the best specialists on one hand and the decrease of the number of aerial near-accidents at the fault of the soldiers on the other. The results of the examination are

summarized by the command at a meeting of special commissions at the end of each month on the basis of report submitted by the Komsomol organizations. Then the best organization is determined, and it is awarded a perpetual prize.

The Komsomol organization in which Captain N. Podol'khovyy works has been rewarded on more than one occasion. In it, every Komsomol member and young soldier reflects, in his personal integrated plan as a participant of the All-Union Lenin Examination, pledges for improving military-technical knowledge, raising class qualifications, mastering associated specialties and participating in efficiency work. For example aviation mechanic V. Tarasov decided to become a specialist 1st class, to master all forms of aircraft preparation to perfection, to exchange his experience in mastering his specialty with his comrades, to help Komsomol member R. Ismailov prepare for his 2d class examinations, and to take part in setting up the training material and equipment base and preparing the visual agitation materials for the new equipment. The soldier is keeping his promise: He has already accomplished some of what he had planned. There are many such Komsomol members in the subunit.

Presentation of reports by Komsomol members has become an effective way of influencing the level of occupational training and setting an example in combat training. One or two persons give reports at each bureau or Komsomol meeting in the groups. This helps to promptly reveal and eliminate shortcomings in the training of Komsomol members and to correct the activities of the committee and the Komsomol bureaus.

The active members are seeking new forms of work which, in combination with commander training and improvement of the training base, would have an effective influence upon expanding the military-technical outlook of the airmen. On their initiative the unit has created, as an example, a group for disseminating military-technical knowledge. In the period following the congress it generalized and disseminated the work experience of the best specialists--officers V. Stafeyev and M. Volkov, Warrant Officer A. Kuz'min, Private V. Dariyev and other Komsomol members.

With the help of the command and the communists, the active Komsomol members have gotten specialty circles working regularly. Studying in these circles, young people improve their occupational knowledge. Technical briefings are given at them by the best trained specialists--Komsomol members and young communists, officers V. Nikityuk, V. Napolov, A. Shityayev and A. Zelinskiy.

Regularly conducted technical "battles" and quizzes titled "Komsomol Member, How Well Do You Know Your Airplane?" elicit considerable interest among the soldiers. How well the airmen have assimilated their functional responsibilities associated with servicing missile carriers is checked in such functions. As a rule they are conducted not less than once every 2 months. According to the established rules, that specialist who demonstrates deep theoretical knowledge of the airplane and of its systems and machine units, and who services the equipment in exemplary manner is declared the winner. This encourages the soldiers to study the aircraft complex more deeply and to maintain a more zealous attitude toward their official duties.

A quiz conducted in the Komsomol organization of the squadron in which Senior Lieutenant R. Iskhakov is secretary of the Komsomol bureau was interesting and instructive. The Komsomol members invited the unit commander, the group engineers and chiefs, the political workers and the party and Komsomol members of other subunits to the quiz. Prizes were awarded to the winners. The young airmen were once again persuaded that modern complex equipment behaves only in the hands of the competent.

In their activities the Komsomol active members devote a great deal of room to timely and substantial visual agitation, and to its effectiveness. For example Komsomol members Senior Lieutenant V. Kartofelev, warrant officers A. Vetashnov and A. Kruze and Private P. Shapovalov set up a display calendar in the technical hut titled "In Aid of the Young Specialist." Excerpts from the basic provisions of the guidelines on the air engineer service and of the regulations concerning technical maintenance of aviation equipment were included in this display. The visual agitation materials publicize the experience of the best airmen and analyze mistakes.

These and other forms of the effort made by Komsomol organizations to publicize military-technical knowledge among the young specialists and to fight for setting a personal example in completing combat training problems and for proficient mastery of weapons and equipment made it possible to significantly raise the professional training level of the airmen. As a result 95 percent of the Komsomol members recently riased their class qualifications, more than 70 percent became specialists 1st and 2d class, and about 80 percent mastered associated specialties.

The Komsomol members are not resting with their present achievements; they are persistently seeking improved forms of work. Thus young airmen of the squadron of the Guards fighter air regiment having Hero of the Soviet Union Guards Lieutenant V. Sobin perpetually enrolled on its roster initiated introduction of classed specialist warning tickets, and Komsomol members headed by Guards Captain V. Bulanov proposed conducting a competition for best unit specialist. Many other useful initiatives are also being introduced. All of this is insuring further improvement of the professional and combat proficiency of the airmen.

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THE SQUADRON SEEN AS THE MOST EFFECTIVE BASE FOR INDOCTRINATION

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) p 12

[Article by Maj I. Drobinka: "With Words and Personal Example"]

[Text] Senior Lieutenant I. Khoroshilov piloted his aircraft confidently. A mosaic of landing lights appeared before him, and searchlight beams illuminated the landing strip. Maintaining his descent and leveling off correctly, the pilot landed his airplane without any mistakes.

The young air warrior was happy: This was his first solo flight at night. As soon as the officer stepped down to the concrete pad, he was surrounded by his friends from the regiment. Khoroshilov was warmly congratulated by the squadron deputy commander Major N. Matyuk, the secretary of the flight party organization Senior Lieutenant L. Korolev and his other friends. The officer's spirits rose even higher when he read what was written in his honor in the combat bulletin.

The active party members led by squadron deputy commander for political affairs Major V. D'yachenko continued on in their effort to efficiently inform their fellow servicemen about the course of the night flying, they acquainted them with the best experience and the achievements of the competition leaders, and they explained the requirements of the CPSU Central Committee, the USSR minister of defense and the commander in chief having a direct bearing on their missions.

In the course of the flying shift the soldiers completed a number of important combat training assignments. The commander, his deputy for political affairs and the party organization secretary took account of the nature of the preplanned exercises in their effort to sensibly distribute the energies of the party and Komsomol active members. They did everything they could to utilize the experience gained during the Great Patriotic War in organizing party-political work, and to make use of the forms and methods of publicizing the activities of the best specialists and the masters of combat qualification. Thus following the example of the veterans, on the eve of the night flying party bureau members, military pilots 1st class Major S. Tarakanov and Captain V. Korolev related to the personnel the experience in conducting air reconnaissance in adverse weather. Lessons with trainers conducted by squadron commander Major S.

Khvalynskiy and flight commander Captain S. Sadov were highly useful to the pilots in restoring their habits of night piloting.

During that night flying shift the active party members proved themselves to be real assistants to the commanders in the struggle to uproot the causes of flying accidents, to promptly prepare the aircraft for take-off with high quality and for outstanding fulfillment of each assignment. For example squadron party bureau secretary Senior Lieutenant Yu. Kholodov and Senior Lieutenant A. Blinov devoted a considerable amount of attention to the engineers and technicians. Before the intense flying began, Blinov met with the aviation mechanics, told them about the leaders of the socialist competition in the winter training period, reminded them of the forthcoming missions, encouraged the new men and tried to raise their confidence in their own strengths. Meanwhile Kholodov talked with aircraft technicians senior lieutenants of technical service A. Drozd and O. Bunakov. He focused their attention on the need for working carefully with the special equipment of the reconnaissance aircraft and with the hardware in the pilot's cockpit, since it all required special attention. The active members constantly remember Lenin'

The active members constantly remember Lenin's words: "No forms of influence upon the masses can produce better results than the strength of personal example." This thought is also emphasized in the proceedings of the 6th All-Army Conference of Primary Party Organization Secretaries. The communists of the squadron described here were real models of fulfilling official and party duties during that flying shift.

As always, deputy commander for political affairs, military pilot 1st class Major V. D'yachenko offered an example worthy of imitation. Having fulfilled his flying assignment with an outstanding score, he met with the active members and explained to them what the priority tasks were. Vladimir Petrovich helped them implement certain measures and to mobilize the people to fulfill their socialist pledges in the competition on missions and standards between the crews and the service groups. Deep military-technical knowledge, a broad ideological-theoretical outlook, high professional skill and proficiency in the air have given Major D'yachenko the moral right to encourage his fellow servicemen to comply unfailingly with the laws and rules of flying. During the night flying the political worker devoted special attention to pilots with training deficiencies. As an example Vladimir Petrovich was concerned about Lieutenant Yu. Golovnya. Would the lieutenant be able to surmount the inner tension that he sometimes experienced in the sky?

Golovnya had made mistakes before in the piloting techniques associated with landing. The political worker meticulously analyzed their causes, he paired up with the young airman for a flight, and he became persuaded that the senior lieutenant was feeling tense, that he was using the control stick to roughly, and that he was unable to correctly distribute his attention while on his landing course. The pilot also felt a lack of self-confidence.

Major D'yachenko shared his observations with the flight commander. They decided together what sort of assistance Golovnya needed. The political

worker also made a conclusion for himself: This pilot needed moral support, he needed help in gaining confidence in his own strengths.

That was not all that long ago, but the young officer's work has noticeably improved. Major D'yachenko became persuaded that work with him had not been unsuccessful. And now he was entrusted with fulfilling his first solo flight at night. The senior lieutenant faultlessly completed his mission, of which the squadron personnel became aware from a flash bulletin published efficiently by the active members.

Throughout the entire night flying shift the active party and Komsomol members efficiently generalized and disseminated the experience of the competition leaders. They posted combat bulletins, flash bulletins and other visual agitation resources describing not only the successes but also the failures of the airmen not far from the start point in a visible, illuminated place on a socialist competition display. In free time between sorties the pilots, technicians and junior aviation specialists could read recent newspapers, learn of the progress in pledge fulfillment and acquaint themselves with the experience of the leaders--A. Sryabin, A. Drozd and others.

Continuous purposeful political indoctrination by communist-leaders and active party members, their words of appeal and their personal example have insured successful fulfillment of missions in night flying.

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HARMFUL EFFECT OF SMOKING ON PILOTS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) p 13

[Article by Col (Res) G. Vishnevskiy: "The Consequences of a Harmful Habit"]

[Text] The following scene could be witnessed at just about every airfield: Walking toward his airplane, the pilot or one of the other crewmembers hungrily takes the last few puffs off his cigarette. And if it is to be a long flight, he smokes a little extra, which does enormous harm to his health.

Unfortunately some people realize this truth a little too late. The following story comes to mind. It happened long ago, and it was exceptional in its own way, but in my opinion it is very instructive. Perhaps on acquainting themselves with it, many people, especially the young, will stop to think whether it is really worth trying tobacco out.

Officer A. Vavilin, with whom I had to serve a while back, had significant flying experience. He had been a participant of the Great Patriotic War, he was older than some of us, and he enjoyed considerable authority among the servicemen of the regiment. In his circle of friends he was referred to respectfully by his first name and patronymical.

Everything was all right, except that it was only a rare occurrence that Vavilin was seen without a cigarette. He smoked a great deal both on the ground and in the air, when he flew piston-engined airplanes. His passion for tobacco transformed into a bad habit. One time, it did the pilot a bad turn.

At the time of the incident we were learning to fly heavy jet bombers, and we began flying them on long runs. Sometimes some of the crewmembers hinted that Vavilan continued to smoke while flying. Unfortunately no significance was attached to this at that time, and no steps were taken against him.

Meanwhile the tobacco "genie" began his malicious work. Always healthy and joyful, Aleksay Andreyevich began complaining that he felt fatigued after flying. It was at that time that flight recorders were introduced into aircraft, and their analysis revealed that Vavilin's piloting skills were becoming worse. Later on, the crew led by the pilot was responsible for a serious near-accident in the air.

An analysis of the barospeedogram of one of the long flights revealed a significant loss in altitude in a leg of the flight that did not call for a descent. The officer attempted to explain the incident by blaming it on bad weather. And the answers the crewmembers offered to the questions were generally confused.

In an attempt to keep their records clean, both the pilot and his subordinates maintained an evasive posture at first. But let us leave the moral side of the issue alone--that would be the topic of another talk. Let us look at how things developed in the air.

The bomber was flying at an altitude of 11,000 meters. After about an hour Vavilin began feeling an insurmountable need to smoke. He transferred control to his copilot and removed his oxygen mask.

Soon the pilot's cabin was filled with bluish cigarette smoke. Aleksey Andreyevich felt easier. But this "pleasure" did not last long: In a few seconds Vavilin lost consciousness. His safety belts were unstrapped, and the pilot collapsed over the steering column with all of his weight. This caused the airplane to dive energetically, and its speed began to increase noticeably.

The copilot was unable to provide assistance to his commander quickly: He was pulling the control stick toward himself, attempting to halt the descent. On his orders the navigator-operator abandoned his work station to place the oxygen mask back on Vavilin's head. The pilot regained consciousness.

"Why are we losing altitude?" were Aleksay Andreyevich's first words.

The bomber was returned to horizontal flight. Need I explain the grave consequences which the bad habit could have led to? By the way, the consequences to Vavilin himself did turn out to be disappointing: He soon had to part with his flying career. Later on, after coming to recognize how dangerous that incident had been, he had this to say:

"I used to smoke when I flew before as well. I always got away with it. And I thought that I would get away with it this time again."

Other lovers of tobacco smoke harbor the same hope. Of course, they do not light up aboard an airplane or a helicopter as Vavilin did. But in breaks between flights, when doing routine work and when at home they smoke like their lives depended upon it. Meanwhile, tobacco is slowly but surely undermining their health. No one can say for sure when the crisis will occur. I know of many pilots who had to part with their flying career much sooner than they had expected. The reason--illnesses acquired owing to smoking.

Now a few words about my own sad experience. I began smoking while I was still in school. By the time I was 40 I sometimes smoked over two packs a day. Nor could I make it through the night without tobacco. It seemed to me that smoking made me alert and provided me with a charge of energy for work.

But then I began noticing that I was getting absent-minded on occasion, that little things made me irritable, and that I was getting extremely tired, especially after high-altitude flights. At first I thought that I was working too hard. Perhaps if I rested, I thought, it would all pass. But the real reason lay in the "pastime" of youth, which had done harm to my body.

How do you quit smoking? I have tried many methods. I reduced the number of cigarettes per day, and I tried smoking every other day. For weeks and even months I would smoke only on rare occasions. But whenever I yielded to the bad habit it would once again traumatize my will, voiding all of the previous effort. The number of cigarettes I smoked swiftly attained its previous norm, and sometimes it even exceeded it.

What helped is a decisive "No!" addressed one day toward smoking. It was difficult at first, but I endured. And it has now been about 20 years that I have not touched a cigarette. It is only a pity that I did this so late. Had I dissociated myself with the tobacco "genie" sooner, perhaps I could have flown heavy bombers for a few years more.

Let me advise, from the bottom of my heart, those who really wish to fly for many long years to drop this harmful habit as soon as possible.

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ECONOMIES IN MATERIEL SUPPORT URGED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 18-19

[Article by Maj Gen Intend Serv S. Glamazda: "Economic Work in the Units"]

[Text] Officer V. Kroshka raised a very important issue in the article "Have the Reserves Been Exhausted?". I think that commanders, political workers and specialists in different services and of different profiles will share their experience and make valuable proposals which will doubtlessly help to strengthen the air force. In turn, I would also like to touch upon a number of aspects of economic work in the air units and subunits.

Our economy is presently at a level of development which insures successful completion of great, complex tasks. Our further movement forward depends in many ways on the quality indicators of the work of all sectors of the national economy, on competent and effective utilization of material, labor and financial resources. The documents of the 26th CPSU Congress note that economic policy is now being developed around what would seem a simple and very mundane core--an economic attitude toward the national wealth, and the ability to utilize everything we have completely and suitably. This idea is expressed in short form by the thesis "The Economy Must Be Economical."

The decisions of the May and November (1982) CPSU Central Committee plenums, and of the Seventh Session, 10th Convocation of the USSR Supreme Soviet, which adopted the law on the state plan for economic and social development of the USSR in 1983 and the USSR state budget for 1983, indicate the ways to fulfill the decisions of the 26th CPSU Congress and implement the party's economic strategy. The plan and the budget for the current year are aimed at raising the effectiveness of social production, dramatically improving its qualitative indicators, finding and introducing additional reserves and universally introducing Lenin's principle of economy and thrift.

To soldiers of the air force, effective utilization of material and financial resources allocated in the support of combat readiness, economy and thrift are highly important issues. Every ruble of state assets must be used strictly according to the intended purpose, with a maximum return for combat and political training.

Each year air force units are fully supplied with the money and materials they need to execute their missions. Owing to the concern of the party and state they are outfitted with modern military equipment. In recent years the material base of combat training has been significantly strengthened and broadened. Conditions necessary for successful assimilation of aviation complexes have been created. The material status of the servicemen and life in the troops are improving with every year.

It should be stated that the air force garrisons are doing a great amount of work aimed at finding additional sources, possibilities and reserves for satisfying the needs of combat training and of the personnel more fully. Commanders, staffs, political organs and party and Komsomol organizations are devoting adequate attention to this important effort. Reasonable initiative by administrators, efficiency experts and inventors is being encouraged in every possible way. Many air force units have built training classrooms, Lenin rooms, practice ranges and sports complexes, and they are improving and landscaping garrison territory through their own efforts, with insignificant outlays. Collection of ferrous and nonferrous metals and their surrender to the state after dismantling scrapped aviation equipment, used batteries and so on has a sizable economic impact.

Military airmen have received the country's Food Program with great inspiration. As the results show, in recent years the air force units have done a great deal of work to economize on bread and to develop subsidiary and kitchen farms. They have produced a significant economic impact. The flight crews, technicians and extended-service servicemen of many units are now fully supplied with fresh vegetables, fruits, greens and livestock products throughout the year by produce obtained from such farms. The money accrued from saving bread and some other foodstuffs (without detriment to the diet of the servicemen) and income from exploitation of orchards and water basins and from selling food wastes and part of the hay harvested by the units themselves from the airfields and from territory adjacent to the garrison as well as other income from farm activities are entered into the monetary fund of the military unit. This fund is spent, on the basis of an annual estimate approved by the commander, to improve the diet of the servicemen, to organize and maintain the kitchen farm, to equip kitchens and dining halls and to satisfy cultural, personal, economic and other needs. At the end of the budgetary year the money in the unit fund is not surrendered as state income; instead, it is subsequently used as a dependable basis for further developing the unit's own food base.

Every military unit can and must have its own subsidiary or kitchen farm. The vacant land and materials are available for this. Their sensible use would be in an effective contribution to the Food Program.

Economization of materials and money in the units cannot be restricted just to expenditures of budgetary allocations. The most important direction in this effort is that of lengthening the life of aviation equipment, armament, trainers and motor transport, and maintaining airfields, airfield structures and work, residential, cultural and consumer service buildings in good condition. Because of violations of the rules of its operation, expensive aviation equipment often breaks down prematurely, resulting in a loss to the state and a decrease

in the unit's combat readiness. When landing strips are in poor condition, engines must be replaced ahead of schedule. Untimely or poor quality repair of work and residential buildings, heating systems, water pipelines and electric equipment can become the cause of accidents and of fires, together with all of the resulting consequences. Moreover because modern flight support and aircraft maintenance resources have been introduced in recent years, the energy consumption by airfield maintenance operations has risen significantly, and consequently the expenditure of all forms of energy, fuel and water has increased. Absence of strict control over the use of fuel and energy resources leads to impermissible overexpenditures that must be paid for on the basis of higher norms.

The system of internal economic and financial control established in the USSR Ministry of Defense guarantees care of material and financial resources. Internal auditing commissions and peoples control groups and posts are created in every military unit. The USSR Armed Forces Internal Service Regulations give the commanders of military units, the chiefs of the logistical and financial support services and the subunit commanders and chiefs certain responsibilities for monitoring the presence and condition of material and financial resources. But we still sometimes encounter shortages, illegal outlays and misappropriation of military property and money.

An analysis of this situation would show that the absolute majority of the violations are made due to a failure to satisfy the requirements of the manuals, orders and statutes, lack of discipline on the part of individual servicemen and poor organization of internal control, which has the purpose of preventing possible violations of economic and financial discipline. Consequently maintenance of the integrity of socialist property and further expansion of economic work would be unimaginable without establishing firm military order in the life of the troops, without maintaining strict control over military discipline, legality and order.

The commanders of airfield technical maintenance units, who are directly responsible for troop administration, play the primary role in organizing economic work and insuring the integrity of national wealth. They are obligated by the nature of their service to uphold military laws in the life of the personnel. It is upon their exactingness, persistence, initiative and business resourcefulness that the state of affairs completely depends. However, it would be extremely difficult for a single commander to resolve all of these issues without the purposeful day-to-day organizational and political indoctrination activities among the personnel. The political organs and the party and Komsomol organizations must be relied on heavily. It is only in this way that success would be insured.

Intensification of economic work in the troops, growth in the effectiveness with which financial, material and labor resources are utilized and improvement of the quality of the work done by officers, warrant officers and workers of the administrative and financial organs are all an objective necessity. The Communist Party and the orders of the USSR minister of defense and the commander in chief of the air force demand this of us as well. Fulfillment of these requirements, implementation of steps to achieve full integrity of socialist property and creation of an atmosphere of intolerance of mismanagement, waste and violations of socialist legality would be a worthy contribution to maintaining high combat readiness in the air force units.

11004
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GROUNDBASED, AUTOMATED NAVIGATION SYSTEMS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 22-23

[Article by Maj N. Pasynkov, military navigator-sniper: "'Straight Pointers'"]

[Text] In combination with ground equipment, modern piloting resources and integrated automated navigation systems make it possible to fly an air route or a preplanned run with high precision. Nonetheless, experienced pilots and navigators believe the radio-compass to be one of the principal navigation instruments.

It is extremely rare for navigators to have to calculate and plot radio bearings and determine aircraft position using an aircraft radio-compass, since there is often no need for doing so. But at high latitudes and in other regions poorly equipped with reference points for radio navigation, the aircraft radio-compass is a necessity. The method suggested below can be used to monitor course.

Aboard airplanes possessing two aircraft radio-compasses with superimposed pointers, the first should be set on the separate homing radio station next on the route, and the second should be set on the one just passed.

We can see from Figure 1 that in the first case the airplane is precisely on the line of his predetermined course, on the axis of the route, and the pointers of the aircraft radio-compass form a straight line.

In the second, owing to a failure to maintain course or an imprecisely set course, a change in wind direction or some other reason the airplane has deviated from the axis of the route. The pointers on the radio-compass dial no longer make a straight line. The obtuse angle they form, САБ, indicates the direction of the deviation. Moreover the size of angle CAP, formed by the tip of the pointer of the first aircraft radio-compass and the blunt end of the pointer of the second, is the course correction (ПК).

When $К_ф$ = ЗПУ [predetermined course angle], angle КДА is equal to angle БАГ, and angle БАГ is equal to angle BAP. In this case these angles are equal to БУ, and БУ equals УС. Angle КЕА is equal to angle CAB, and it is equal to ДП as well. ПК = БУ + ДП.

If the airplane is at point A (Figure 1) at any given course, the size of angle CAP would not change at the given moment; instead, it would simply assume a different position on the dial.

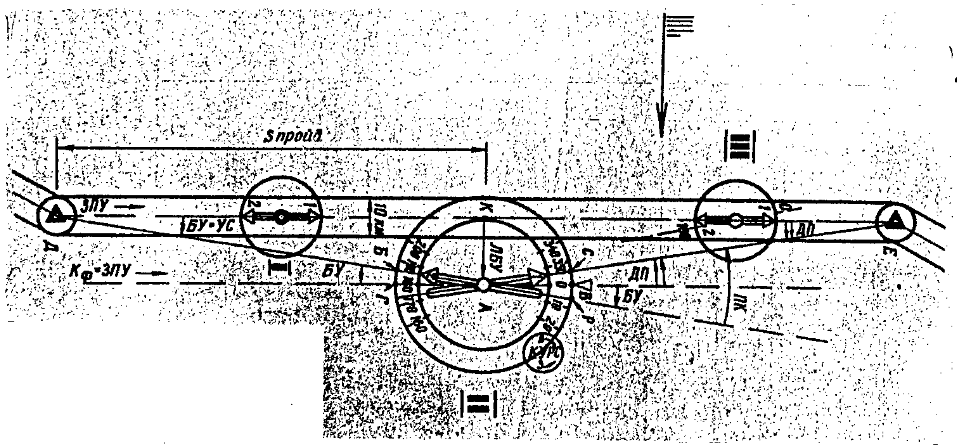
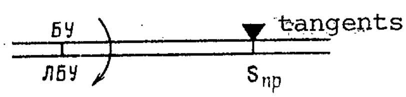


Figure 1

Distance must be monitored rather precisely so that the distance traveled in the particular leg can be determined at any moment ($S_{пр}$). Using $S_{пр}$ and angle БАГ, we can determine ЛБУ = КА from the NL-10 slide rule using the tangent scale:



If K_{Φ} is not equal to ЗПУ then the course setter on the navigator's dial must be used to make the 0-180° line parallel to the axis of the route. For example if K_{Φ} is 5° greater than ЗПУ, then the course setter must be used to set 5° opposite the triangular mark on the scale, while when K_{Φ} is less than ЗПУ, the setting should be 355°. The pattern would be as shown in Figure 1.

In the third case, after the course correction, the airplane is back on the axis of the route. At this moment the course is set with a consideration for $УС_{\Phi}$, and then the subsequent flight would be precisely on the axis of the route.

The "straight pointers" method is simple, it is easy to understand visually, and it does not require calculations or the plotting of radio bearings on a map. It permits detection of the slightest deviations from the axis of the route and their quick correction by turning in the direction opposite to the apex of the obtuse angle, until such time that the pointers of the aircraft radio-compass form a straight line. When the turning point of the run is 20--30 km away, the aircraft radio-compass set on the previous homing station must

be reset on the next turning point. The distance traveled can be checked by resetting the "backward-looking" aircraft radio-compass to a lateral reference point, and the bearing can be read. If the course system fails, a flight on a predetermined air route can be continued without difficulty, and rather precise corrections can even be made in the gyro course indicator. The "straight pointers" method can also be used when guiding the plane onto an air route (preplanned route) if this is to be done not at a regular turning point but at some arbitrarily selected point along the run. After the pointers become superimposed in a straight line (in anticipation), any further correction can be made at the turning point.

The same method can be used successfully when making a landing approach using an instrument landing system in adverse weather. The most critical leg of the route in this case would be between the homing beacons, because at landing speed cross winds sometimes cause sizable drift angles resulting in swift growth of the deviation from the alignment on the landing strip. If this is not noticed in time, a considerable correction would have to be made before the close-in homing beacon is reached, and sometimes it may also require a second attempt. By using the "straight pointers" method in this leg, the pilot and the navigator would easily detect the deviation and correct for it quickly. For example if the airplane is between a long-range and a close-in homing beacon and its deviation from the axis of the landing strip is 50 meters, then the angle between the pointers would be 4°. This would be immediately noticed. It would be easy to correct the error by making a double correction in course. After the airplane passes the close-in homing beacon the pilot would have visual contact with the landing strip, and a safe landing would be insured (Figure 2).

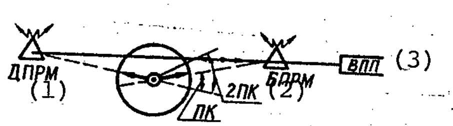


Figure 2

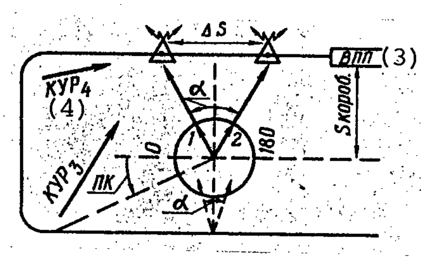


Figure 3

Key:

1. Long-range homing beacon
2. Close-in homing beacon
3. Landing strip
4. Relative bearing of radio station

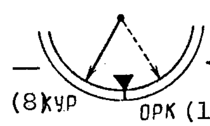
The approach diagrams of many airfields have entry lines plotted in relation to different points on their box patterns. It is thus sometimes difficult to determine the width of the box pattern without range-finders. This can be done in the following way (Figure 3).

We set the first aircraft radio-compass on the long-range homing beacon and the second on the short-range homing beacon. Knowing the distance between them, ΔS, and reading angle α between the pointers of the aircraft radio-compass the moment the airplane is abeam of the homing beacons, we determine S of the box pattern using the tangent scale of the NL-10 slide rule:

MEAN RADIO DEVIATIONS FOR AN AN-24 AIRPLANE

Upper Position of ARK-11 Aircraft Radio-Compass No 1 (OPK is made counterclockwise)

(1) ОРК	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345
(2) Р	0	+12	+18	+20	+15	+7	0	−9	−14	−17	−19	−13	0	+13	+17	+19	+14	+6	0	−5	−14	−19	−17	−11
(3) Каким винтом докомпенсировать	0	0 15	15	30	45	60	90	120	135	150	165	165 180	180	180 195	195	210	225	240	270	300	315	330	345	345 0



(4) Для уменьшения показаний КУР — винт заворачивать,
(5) для увеличения показаний КУР — винт отворачивать.

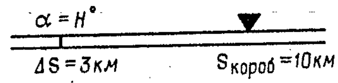
(6) Для уменьшения показаний КУР — винт отворачивать,
(7) для увеличения показаний КУР — винт заворачивать.

Lower Position of ARK-11 Aircraft Radio-Compass No 1 (OPK is made clockwise)

(1) ОРК	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345
(2) Р	0	+12	+16	+17	+14	+9	0	−5	−6	−11	−11	−9	−1	+6	+12	+10	+8	+4	−1	−7	−14	−17	−14	−10
(3) Каким винтом докомпенсировать	0	0 15	15	30	45	60 75	90	120	135	150	165	165	180	195	195	210	225	240	270	300	315	330	345	345

Key:

1. Radio compass reading
2. Radio deviation
3. Screw used for compensatory adjustment
4. To reduce KYP readings, tighten screw
5. To increase KYP readings, unwind screw
6. To reduce KYP readings, unwind screw
7. In increase KYP readings, tighten screw
8. Relative bearing of radio station



After getting the actual width of the box pattern, we enter in the correction to the course to the third turn and thus correct the error.

However, if use of radio-compasses is to be highly effective, radio deviations must be set as meticulously as possible aboard airplanes possessing template-type radio deviation compensators. Average values are set in each airplane at the plant. Corrections are made by removing the loop antennas and then compensating for radio deviation with a consideration for the averaged graph of ΔP. There is no special difficulty in compensating for residual ΔP.

An airplane with working engines and with its apparatus turned on is oriented by means of the deviational direction-finding set on a magnetic course equal to the magnetic heading or the magnetic bearing to the radio station. The directional gyro is set at 0 or the magnetic bearing to the radio station. The setting error is corrected for by turning the frame itself (such that the relative bearing of the radio station is 0).

It is easy to make the compensatory adjustments with screws on a 24-course template (it usually takes just one revolution), since the errors are rarely more than 4-5°. The airplane must be oriented on the course by means of the directional gyro. The work time would not take more than 30 minutes. Thus the radio deviation would be compensated for. Accuracy can be up to ±1°. This is especially necessary in the 3-330° and 150-210° sectors.

The screws used to make the compensatory settings and the average radio deviations of the AN-24 and AN-26 airplanes are shown in the table. Compensatory adjustments can also be made aboard a "cold" airplane with the apparatus turned on. In this case, however, the ΔP that is unaccounted for would inevitably make itself known.

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AVIAN THREAT TO FLIGHT SAFETY DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 26-27

[Article by Sr Lt V. Grabov: "From a Graphical Model to an Ornithological Prediction"]

[Text] The blow was unexpected. The glass pane on the left side of the cockpit disintegrated instantaneously. The pilot was hurt. But with the help of his leader he surmounted all of the difficulties and landed the damaged airplane at the nearest airfield. This serious near-accident occurred due to a collision with a bird.

Of course, such cases are rare. To minimize them, we have initiated an extensive search for effective ways to prevent collisions and to raise flight safety and the quality of ornithological support to flying. Extensive ornithological information and improved technical resources are being used for this purpose.

The flight control group, which possesses the appropriate radar sets, constantly monitors the airspace. I could cite many examples in which a timely command from the ground to change altitude or flying direction averted undesirable consequences. Nonetheless, collisions with birds still happen, even within the range of altitudes kept under surveillance. More than likely, the reasons behind this lie in the way equipment is used and operated.

I think that on the whole the impact achieved from the use of radar ornithological information and forecasting depends not only on the quality of this information--its completeness, dependability and timeliness, but also on the way all of this information is presented. Each member of the flight control group and the pilot are characterized by unique attention mobilization parameters. Information processes represent the bulk of the content of interaction between the flight control group and the pilot in the control system. Creation of favorable conditions for information exchange thus becomes one of the key problems, inasmuch as disturbance of such interaction can become an independent stress factor that disorganizes the effort to insure adequate flight safety. This problem acquires special acuity in connection with the increasing degree of automation of flight control, where man is given the role of a monitor, though he is still able to assume control at any time. I think that it is

precisely here, in improving the quality of ornithological information and of ornithological forecasts in general, that we can find the way to improve the impact produced by using ornithological information.

Having studied different prognostic data and defining the value of these data in association with the needs of the flight control group and the flight crews, we came to the conclusion that we need graphical prognostic information indicating the routes and regions of bird migrations in space and in time. After all, a prediction made without such an association does not have much practical use. Moreover, by using such information we can solve another problem more successfully as well--developing a general theory of ornithological prediction based on models characterizing the influence of particular physical processes within the complex "atmosphere-hydrosphere-biosphere" system on change in the ornithological situation.

Much is already known about the life of birds and about the way weather influences them. But we do not yet have a satisfactory general prediction theory. This is why predictions are still inadequate.

Our research on the ornithological situation and our studies conducted on factors influencing it created the groundwork for using quantitative characteristics in resolving organizational problems of providing ornithological support to flying. In turn, this raises the dependability of predictions and makes it possible to utilize modern mathematical methods and simulation.

After making radar observations and visual ground and air observations we built a general model of the ornithological situation. Its vertical plane may be represented arbitrarily in the form of three tiers. The first considers bird flight at altitudes up to 100 meters. The second considers bird flight at altitudes from 100 to 500 meters. And the third mainly considers migrating and predatory birds.

These tiers contain different numbers of birds depending on the period of their life, the weather conditions and the time of day. It should be noted that migrations and regional flights may be observed in the first tier as well. But at such a time the birds "merge" with the inhabitants of this tier, and thus they present a danger only to take-off, landing and preplanned flights at low altitude, without being a nuisance to flying on preplanned routes at moderate and high altitudes within the far control zone, where flocks fly the same migration routes but significantly lower.

This premise is precisely what we take as our starting point in research supporting simulation of the ornithological situation. We must also consider that birds are constantly present within the range of altitudes of the first tier, irrespective of weather and time of year. For practical purposes no forecast can assist a crew in averting collision with birds during take-off and landing owing to the particular features of flying at minimum altitude, where the large angles of movement of observed objects are compounded by restricted view, which significantly reduces the effectiveness with which a pilot can detect birds on his own, and which limits or generally precludes the possibility for maneuver.

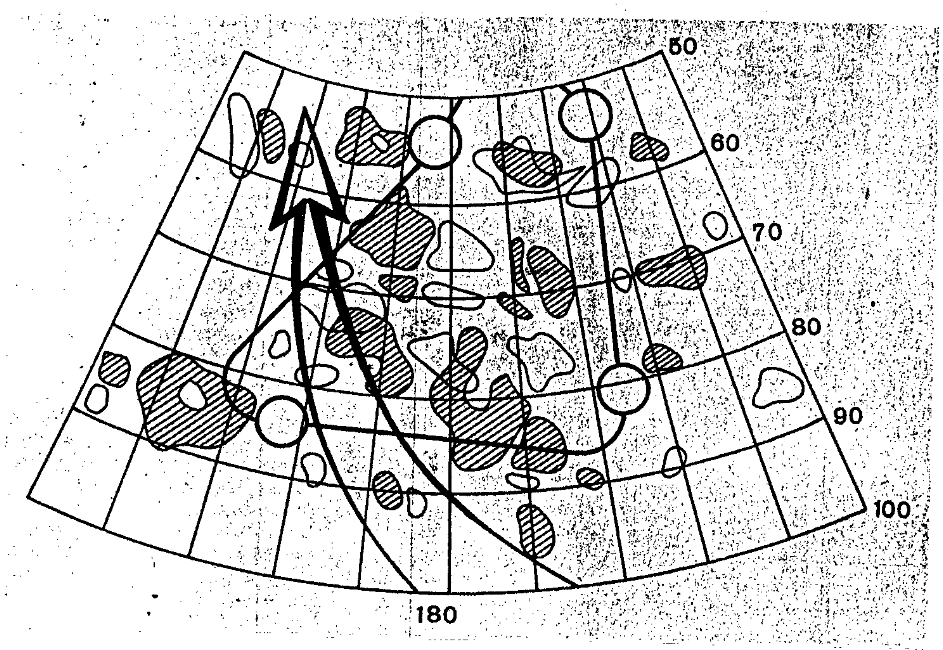
Therefore repelling resources and other means of bird control would be the most effective ways to achieve ornithological safety in the first tier, as would visual and radar observation with the objective of providing the pilot current information or avoidance instructions.

Many years of experience have shown that dependable forecasts, radar observations and timely instructions from the ground produce the greatest impact in this respect within the range of altitudes of the second and third tiers.

For the moment our initial model of the ornithological situation is rough, and it does not claim to serve a greater purpose than a reasonably useful approximation of the real situation. It will be able to achieve a sufficient degree of perfection only as more current information is processed. But simulation does provide more facts to the flight control group and weather specialists to work with, and it reveals new information that could be acquired by other means only with incomparably greater difficulty. Moreover it provides a training situation, which by itself makes it possible to produce more substantial results in ornithological flight support.

The figure below is an example of a graphical model of an ornithological situation. It shows the regions and routes of bird flights determined from numerous observations made over a period of 3 years during September-November migrations from 0700 to 2400 hours. Cross-hatching indicates the areas of the most intensive flight associated with feeding. Movements within such areas are chaotic, obviously depending upon the quantity of feed available.

No clear system was revealed in flying at altitudes up to 500 meters. However, zones in which traces from flocks are noted most frequently in the morning and in which they disappear in the evening hours are detected in this range. These areas are not cross-hatched. The arrow shows the migration route.



The model was built for simple weather conditions, when flying is intensive within all tiers. As was noted above, the preparations themselves for simulation--mainly making radar observations and gathering radar data--are useful in and of themselves. They provide a better understanding of the flying region's ornithological situation, they provide a grasp of both the situation as a whole and of its details, and they bring concealed possibilities to view. The main prerequisite of success is for the flight control group and the weather specialists to participate in the creation of the models, including their own observations in them so that a single information system could be formed. Were two specialists to use significantly differing models, it would be difficult to achieve mutual understanding between them.

But that is not all. The model must come to life, it must operate independently. Only then could it be used for prediction purposes; otherwise it would remain a fruitless scheme. Weather is the background on which an ornithological situation arises. Possessing data on the anticipated meteorological conditions, we must select one of several possible models; it would be natural to presume in this case that a specific situation exists in relation to each type of weather conditions. Therefore what we need most of all is dependable meteorological information.

Let us return to the graphical model. Introducing prognostic meteorological information, we place it into motion. For example assume that passage of a cyclone is anticipated, which is associated with a worsening of the weather, precipitation and strong winds. According to the forecasting recommendations we should expect a significant decline in the intensity of bird migration and of flights by individual flocks. The flight routes of the third tier would disappear from our model, with only local flights to feeding and nesting grounds remaining; migration and regional flights would disappear from the second tier.

To arrive at a concrete forecast we can plot a vertical cross section of the ornithological situation along a preplanned flight route. During the time of flying, this situation assumes a certain intermediate state; the picture continues to change, and therefore we must also know the intermediate characteristics of the situation. The model provides quick information owing to which the flight control group can receive a response to the question as to the most probable places of arisal of traces from bird flocks on the detection radar displays.

Deep, purposeful scientific processing of practical data and experience coupled with the use of new methods, including graphical simulation, will make it possible to raise flight safety in the ornithological respect.

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DRIFT IN NAVIGATION DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 28-29

[Article by Col N. Loshkarev, military navigator 1st class: "Deviation From the Route (Conclusion)"]

[Text] Conclusion. See issue No 3 for start.

All of the recommendations given in the first part of this article are also valid in relation to pilots flying airplanes equipped with an IKV [inertial vertical course indicator], in cases where prior to the flight the magnetic declination of the take-off airfield is set in the KM-2 correction mechanism after setting the IKV. However, there is a possibility for obtaining the current magnetic course on the NPP [not further identified] of such airplanes in the course of a flight. For this purpose, after the IKV is set, rather than setting the magnetic declination of the take-off airfield in the KM-2 correction mechanism, the latter should be zeroed. In this case if during the flight the pilot must have the magnetic current course displayed for some reason on the NPP, he could set the MK-GPK-ZK [magnetic course--directional gyro--presecribed course] switch at the MK position, adjust the IKV using the magnetic course adjustment button while maintaining straight horizontal flight, return the switch to its GPK position and continue the flight with the magnetic current course displayed on the NPP.

If prior to the flight the magnetic declination of the take-off airfield is set in the KM-2 after adjustment of the IKV, the pilot will not be able to display the magnetic current course on the NPP during the flight.

Flights on preprogrammed routes entailing a return to the take-off airfield are another matter. In them, after adjustment of the IKV it would be suitable to set the KM-2 not at zero but at the relative magnetic declination of the take-off airfield, ΔM_y (if axis X of the great circle coordinate system of the RSBN-6S is in line with the true meridian of the take-off airfield, then $\Delta M_y = \Delta M$). In these cases the pilot must do the following. If for some reason he adjusts the IKV with the magnetic course adjustment button while in the air after setting the MK-GPK-ZK switch at position MK, or if he turns on the stand-by magnetic course mode and the readings on the current course scale of the NPP subsequently become true, then the IKV will continue to display the

course relative to axis X of the great circle coordinate system of the RSBN-6S, and not relative to the current magnetic meridian, as had been the case when the KM-2 had been zeroed after adjusting the IKV. After this, the flight could be continued on the preprogrammed route making full use of the RSBN-6S.

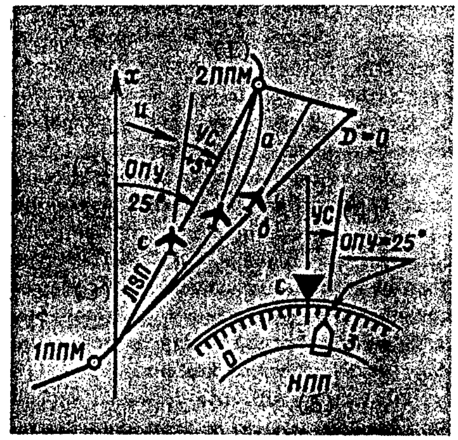
But if prior to a flight on a preprogrammed route entailing a return to the take-off airfield $\Delta M=0$ rather than the relative magnetic declination is set in the KM-2 after adjustment of the IKV, were the pilot to adjust the course in relation to an auxiliary position finding station by using the magnetic course adjustment button prior to take-off or while in the air, the IKV would display the course relative to the current magnetic meridian, and not relative to axis X, and it would be impossible to use the RSBN-6S system to fly the preprogrammed route. It could be used only when working with an unpreprogrammed radio beacon of an RSBN [radio navigation system of local air navigation]; in this case only the readings of the PPD-2 indicator and the KUR [relative bearing of radio station] pointer on the inside scale of the NPP would be true: The back end of the pointer would show the true bearing of the airplane relative to the RSBN radio beacon, while its pointed end would show the true bearing of the RSBN radio beacon. However, the reading indicated by the pointed end of the KUR pointer on the outer scale of the NPP would differ from the course angle of the RSBN radio beacon by an amount equal to the magnetic declination of the flying region.

During a flight, Major B. Sorokovikov discovered an excessively large deviation from his prescribed route after 40 minutes of flying. Initially the pilot used the RSBN-6S (he kept the prescribed course pointer opposite the triangular mark) as long as radio correction from the RSBN radio beacon of the take-off airfield was available, and after he was beyond its range, the pilot flew without radio correction. In both cases Officer Sorokovikov maintained the course without monitoring his heading in any other way. Prior to take-off he did not study the weather along the route well, he did not make the appropriate conclusions concerning the weather, he failed to refine his flight calculations in relation to actual wind speed, and at the flying altitude the winds were fast and directed perpendicular to the line of flight.

Major Sorokovikov did not know how to maintain the line of his predetermined course using the RSBN-6S in a cross wind. In the meantime, the absolute majority of airmen flying with the RSBN-6S learned to do so long ago. Nonetheless, certain theoretical premises must be recalled.

As we know, the RSBN-6S is designed to use the course method of getting an airplane to a preprogrammed point. In this method the navigation system determines the course angle of a PPM [route turning point] and the range to it. The prescribed course pointer of the NPP indicates the course angle of the PPM in the form of the prescribed bearing toward it (without considering the drift angle). If this pointer is set opposite the triangular mark and kept there during the flight, the longitudinal axis of the airplane (the vector of the airspeed) would be directed toward the PPM, while if a cross wind is present and radio correction from an RSBN radio beacon is available, the flight trajectory would be a radiodromiya [translation unknown] (see Figure, position a).

without radio correction, however, the flight trajectory would be a straight line that does not pass through the PPM (position *b*).



Key:

1. PPM
2. Great circle course angle
3. Line of predetermined course
4. Drift angle
5. NPP

Thus when radio correction from an RSBN radio beacon is available and the prescribed course pointer is kept opposite the triangular mark, and when the plane is under director or automatic control, the aircraft will pass over the PPM even though it does not fly along the LZP [line of predetermined course] (see Figure, position *a*); if the airplane flies without radio correction, it will not pass over the PPM (position *b*).

If the airplane is to fly the LZP using the RSBN-6S at a time when radio correction by an RSBN radio beacon is available, when performing his turns the pilot must make sure that the prescribed course pointer gives a reading on the moving scale of the NPP equal to the great circle course angle for the given leg of the route (see Figure, position *c*). Rather than simply adjusting for the drift angle, the pilot must keep the prescribed course pointer on the reading equal to the OPU [great circle course angle], similarly as when a pilot descending on his landing course keeps the aircraft radio-compass pointer aligned with the prescribed course pointer, which remains fixed on a reading equal to the landing course. The only difference would be that when flying toward a PPM, the role of the aircraft radio-compass pointer would be played by the prescribed course pointer, which is continually oriented on the PPM. If the pilot is able to maintain this position, he can determine the drift angle as the difference between the prescribed and current courses.

If a pilot is to fly on an LZP using an RSBN-6S without radio correction by an RSBN radio beacon, prior to the flight he would have to calculate the drift angle, and in the air he would have to pass precisely over the flight departure point (the PPM); after passing over it, he must maneuver the airplane in such

a way that the prescribed course pointer would remain fixed on a reading equal to the OPU of the given leg of the route, and so that the current course would be such that the sum of it and the drift angle would be equal to the prescribed course--that is, the OPU. If the calculated drift angle is +5° and OPU= 25° (see Figure, position *c*), the prescribed course pointer must be kept at 25°, while the current course should be maintained equal to 20° (20°+5°=25°).

Were he to fly along the LZP in the first leg of the route (the RSBN radio beacon was adopted as the flight departure point), with correction assistance available from this radio beacon the pilot should not have kept the prescribed course pointer opposite the triangular mark. Instead, while in radio position recorder mode the pilot should have kept the back end of the KUR pointer opposite the point on the moving scale of the NPP equal to the great circle bearing of the first PPM.

It did not take the pilots any special effort to preform the corrective actions in these cases. The officers simply should have systematically deepened their knowledge of the physical essence of the readings of the navigation instruments, and they should have known more about how to use the navigation systems installed aboard the airplane. This could be achieved only through purposeful selection of piloting study subjects and their deep study well before flying begins. It would also require methodologically competent organization of the preparations pilots make independently for flying, systematic 15-minute navigator training sessions based on a meticulously written plan, flight in trainers employing navigation systems in all of their modes, and testing of the preparedness of flight crews for flights in such a way as to keep an unprepared pilot (crew) from flying.

There is one more question I would like to consider.

Documents regulating operation of complex navigation systems make the prescription that before an airplane is taxied from its parking pad, the controls of the complex navigation system must be located in such a way that when the aircraft taxies out, takes off and performs its maneuver to assume the preplanned route, the prescribed course pointer would indicate the prescribed course ($\psi_{зад}$) toward the first PPM, so that the PPD-2 (or some other range indicator) would indicate the range to it, and so that the KUR pointer would indicate the course angle for the RSBN radio beacon of the take-off airfield. Flying experience has shown that compliance with these requirements would not promote greater flight safety in the vicinity of the airfield during the time that the pilot (the crew) maneuvers onto its preplanned route. The reasons for this are as follows.

Pilots maneuvering onto their preplanned route aboard airplanes not equipped with complex navigation systems have become accustomed to setting the pointer of the course indicator on the reading equal to the landing course, which helps them to orient themselves in space more accurately, since the bearing to the landing strip relative to the airplane is what is shown. When maneuvering onto a preplanned route aboard airplanes equipped with complex navigation systems, rather than indicating some $\psi_{зад}$ relative to the first PPM, which the pilot does not need at this moment, the prescribed course pointer should perform the

same function. But if a turn in the direction of the first PPM is foreseen at the airfield immediately after the take-off is finished, the prescribed course pointer can and must be switched to indicate $\psi_{зад}$ toward the first PPM prior to taxiing out.

Next. When maneuvering onto a preplanned route, it is very important for the pilot to know the range to his RSBN radio beacon rather than to the first PPM, since the instructions on flying to other airfields indicate the ranges at which a particular turn must be started when maneuvering onto the required course. If the range indicator (PPD-2, PNP and others) indicates the range to the first PPM during such a maneuver, the pilot (the crew) is unable to determine the moments at which turns begin.

One more thing. According to instructions on flying to other airfields from a circular take-off pattern, the crews are obligated to report passage over the traverse when they pass over the traverse of the long-range precision approach radar, and not that of the RSBN radio beacon (in rare cases, when airplanes of the same type are flown, passage over the RSBN radio beacon is generally reported). Crews making a transfer flight in a circular pattern also report passage over the traverse of the long-range precision approach radar rather than the RSBN radio beacon. If the preplanned route is to be assumed from a circular pattern and the KUR pointer shows the direction to the RSBN radio beacon rather than the long-range precision approach radar, the pilot may make a mistake in determining the moment to report passage over the traverse, which would be undesirable to himself, to the flight leader and to other crews in the circular pattern. Moreover some airfields require assumption of a preplanned route over the long-range precision approach radar.

Before completion of the maneuver of assuming the preplanned route, the controls of the complex navigation system must be positioned in such a way that the readings of the navigation instruments would permit the pilot to accurately maintain the trajectory of the departure maneuver. And after this maneuver is completed, when this information is no longer needed, the controls must be immediately set such that the readings would support flight along the preplanned route.

11004
CSO: 9144/272

DEVELOPMENT OF LATTICE WINGED AIRCRAFT DISCUSSED

Moscow AVIATSIYA I KOSMONAVTKIA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 30-31

[Article by Engr-Lt Col B. Ul'yanov, candidate of technical sciences, and Engr-Col V. Shitov, candidate of technical sciences, USSR State Prize laureate: "Lattice Wings"]

[Text] Plans for airplanes with wings consisting of several surfaces located one above the other to form a lattice profile appeared at the end of the last century. Thus in 1895 Ye. Fedorov, a military engineer, suggested a plan for a pentaplane aircraft, which was built but not tested. Another inventor, V. Savel'yev, built a tetraplane aircraft that exhibited good qualities in tests.

Referring to several such designs as examples, N. Ye. Zhukovskiy wrote the following in his work "Theoretical Principles of Aviation": "The hope in former times was to arrive at a good lifting force by building lattice-type supporting surfaces." Zhukovskiy and his students conducted theoretical and experimental studies on such carrying systems. Later on, polyplane wings were considered in application to biplanes as their logical continuation. Polyplane systems are being created today as well. However, the majority of airplanes have been built on the basis of the monoplane scheme.

Polyplane lattice systems have now entered a new phase in their development. They are used in the design of flying craft intended for various purposes. The reason for this is, on one hand, that the lattice wing retains a number of the properties of the conventional monoplane wing, and on the other that it is distinguished from it by a number of other geometric parameters which could be controlled to effectively change the streamlining conditions, and consequently to affect aerodynamic properties. Consequently we can look at lattice wings as a new form of carrying, stabilizing and controlling surfaces, which under certain conditions possess a number of advantages over traditional monoplane wings.

Lattice wings are framework systems consisting of several identical plates secured together by side members. At least two basic forms of such wings are distinguished: frame, in which the surfaces are parallel to one another (Figure 1*a*) and honeycomb, in which the surfaces intersect each other at a certain angle--90° for example (Figure 1*b*).

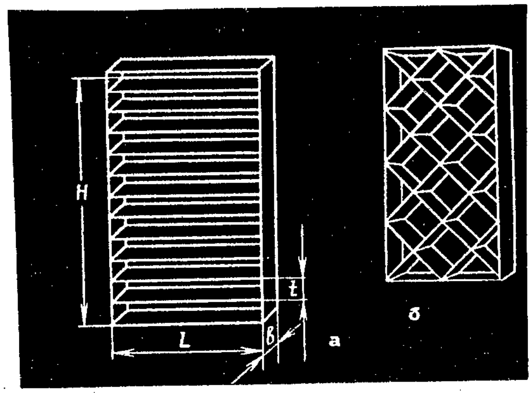


Figure 1. Examples of Lattice Wings: *a*--frame wing; *b*--honeycomb wing

In addition to geometric parameters inherent to the conventional monoplane, aerodynamic calculations associated with the lattice wing require a number of new geometric parameters: $\bar{t}=t/b$--relative spacing (t--distance between two neighboring planes, b--chord of plane); $\bar{H}=h/l$--relative height (H--height, l--span); $n=(H/l)+1$--number of planes in the lattice wing, and a number of other parameters.

Usually in our calculations we compare the aerodynamic characteristics of a lattice with the total area of all planes, which is defined as $S=nS_{pl}$, where $S_{pl}=lb$ is the area of a single plane.

Integrated theoretical and experimental research on the aerodynamics, design, strength, mass and manufacturing technology of lattice wings paved the way for a rebirth of lattice wings at an entirely new level to perform new tasks. These studies were conducted by a collective of scientists under the guidance of Prof S. Belotserkovskiy at the Military Air Engineering Academy imeni N. Ye. Zhukovskiy. The specialists studied the aerodynamics of the lattice wing within a range of velocities from low subsonic to high supersonic.

The streamlining pattern of a lattice wing differs significantly at subsonic and supersonic speeds. At subsonic speeds the flow perturbations elicited by each plane extend back a rather considerable distance, which is why the planes have a mutual influence upon one another. At supersonic speeds the zone of perturbed airflow is restricted to shock waves or characteristics. At supersonic speeds we observe both streamlining situations: mutual influence of the planes, and the absence of such influence. That is, when the velocity of the unperturbed airflow is supersonic and the shock waves or characteristics elicited by one plane strike a neighboring plane, mutual influence would occur. In other cases it would be absent.

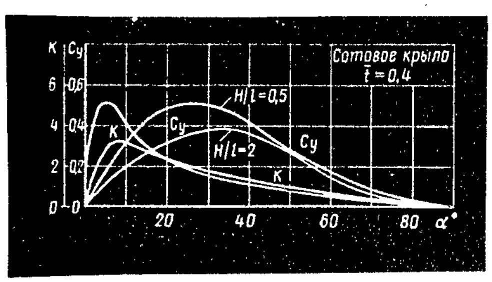
Presence of mutual influence depends on the relative spacing of the lattice, the airflow rate and the angle of attack. Experiments and calculations show that for a frame lattice wing, there is no mutual influence at angles of attack of 5-8° and a relative spacing $\bar{t}=0.5$ at $M \gg 2.3$. In a honeycomb wing, meanwhile, mutual influence always occurs near the points where the planes meet.

As is the case for a frame lattice wing, however, if the cells of the honeycomb are square and the relative spacing between the cells is identical, mutual influence may be ignored.

In order that the greatest carrying properties and the least resistance of carrying surfaces can be achieved, the latter are designed to insure smooth streamlining (without separation). Lattice wings with a spacing less than unity offer better streamlining conditions than does an isolated profile. Neighboring planes promote smooth streamlining, directing the oncoming flow in the appropriate fashion. The lower surfaces of neighboring planes have a positive effect on the upper surfaces of planes: Smooth streamlining appears at large angles of attack and persists over highly curved planes. This phenomenon makes lattice wings different in that the critical angles of attack for them are significantly greater that for a single plane. Thus for wings with a plane spacing of 0.5 subjected to airflows at angles of attack from 0 to 90° and M=0.6, 0.7 and 0.8, $C_{y_{max}}$ was obtained at α=30°. The same situation also held for other M numbers.

Also interesting is the fact that at subcritical angles the lifting force coefficient drops smoothly, which makes it possible to utilize wings at these angles successfully (Figure 2).

The aerodynamic quality of lattice wings is not great, not more than 6. Comparison of the coefficients of aerodynamic quality of lattices situated horizontally, $H/l < 1$, and vertically, $H/l > 1$, shows that the K_{max} of horizontal lattices is greater than the K_{max} of vertical lattices. For example the maximum quality of a straight lattice with H/l=0.5 is 5-6, while for a lattice with H/l=2 maximum quality is only 3-3.5. This is explained by the fact that the carrying properties of horizontal lattices are greater than vertical ones at M numbers less than 2.5. At greater M numbers this difference is practically nonexistent.



(1)

Figure 2. Dependence of C_y on Angle of Attack for a Honeycomb Wing

Key:
1. Honeycomb wing

There is another property that has been established for lattices. If we look at change in the derivative of C_y^α for a lattice wing with respect to M numbers, we find that a practically constant C_y^α value can be obtained for the entire

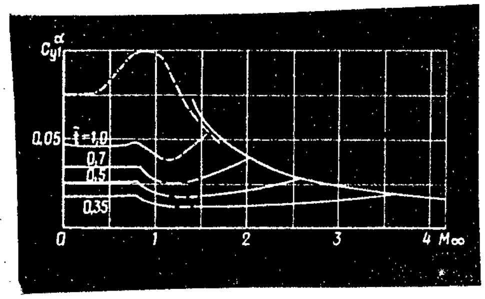


Figure 3. Dependence of C_y on Flying Altitude

range of M numbers. This property of lattice wings is especially important to a flying craft with a center of gravity that shifts significantly during flight. Such an effect is not observed with a monoplane wing (Figure 3). By selecting the appropriate lattice spacing and other geometric parameters, we can arrive at wings exhibiting different laws of change in carrying properties.

By using lattice wings on a flying craft, we can achieve greater lifting force than a monoplane wing within a prescribed volume. At supersonic speeds the planes of the lattice can be situated rather closely to one another without mutual influence, as a result of which a considerable total area is formed. As an example at M=4 the lifting force of a lattice exceeds the lifting force of a monoplane wing of the same volume by a factor of 3.

The chord of the planes of a lattice wing is very small. Consequently the pivoting moments arising on the wing are also small, which is extremely important to reducing the consumed power of steering engines, if the lattice wings are used as controlling surfaces.

Aerodynamic research on lattice wings and on their unique features showed that sometimes they are better suited than monoplane wings, and in a number of cases the latter do not possess certain characteristics at all.

Lattice wings are now being used rather extensively in various areas of technology. They are installed as stabilizers in the emergency rescue system of the "Soyuz" spacecraft (see photograph [not reproduced]). They are used in the construction of hydrofoil vessels, they are employed in trawls intended for various purposes, and they are used as braking and gliding devices on aircraft.

Lattice wings may be folded along the body of an aircraft during transportation and when in flight, when there is no need to have them deployed. They can also be forced into deployed position by aerodynamic forces. Being hinged to the body in this case, they are introduced quickly into the airflow and produce a great braking effect.

The wings of the emergency rescue system of the "Soyuz" spacecraft are mounted along the body of the deflector, and they remain in nonworking position until they are required. When they are deployed, they work as stabilizers, helping to direct the system to the point where the parachute systems are activated following automatic jettisoning of the deflectors together with the wings.

To permit practical use of lattice wings on real structures, professors V. Frolov and A. Tyulenev conducted considerable research on the technology of their manufacture and on the choice of the available structural materials, and they calculated the strength characteristics and evaluated the weight characteristics as part of an integrated program. The results demonstrated a number of advantages over monoplane wings.

The principal unique feature here is the sensible spatial distribution of the force elements of the wing, such that the plane of greatest structural rigidity coincides with the plane of action of the greatest aerodynamic loads. This design also produced a significant payoff in weight.

Calculations also show that to achieve a prescribed lifting force, a lattice wing could be built that is three to five times lighter than a monoplane wing. A monoplane wing usually consists of numerous different parts that are glued, riveted or welded together, or joined with screws. A lattice wing, meanwhile, consists of identical parts. Therefore it is much easier to assemble them on a building slip and complete the entire soldering operation within a single heating cycle. The assembly procedures have now been worked out very well and introduced into practice. Moreover research has been conducted on a broad range of construction materials, including compound materials. Comprehensive research was conducted on thin strips out of which wing planes can be assembled, and on the possibility of using hollow planes with a corrugated filler. There are no longer any difficulties in creating a lattice which would operate normally at aerodynamic heating temperatures of up to 1,600°K.

Of course, lattice wings will not completely replace monoplane wings in practical aircraft design, but without a doubt in a number of cases they will satisfy the tactical and technical structural requirements better than monoplane wings.

11004
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WEIGHT PROBLEMS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) p 32

[Article by Capt R. Kadyrov, candidate of pedagogical sciences: "Accessible to All"]

[Text] A regular medical examination was being conducted in the air unit. One of the pilots, a young, likable captain, stepped onto the scale and shifted the sliding weight over to his usual place.

"Eighty-seven kilograms," he announced cheerfully.

"Isn't that a little too much?"

"Doctor, a big body means a healthy spirit," the pilot joked.

"Not quite so," the physician replied. "At 30 years old and a height of 174 centimeters, your maximum allowable weight is 82 kilograms. By the way, being overweight is one of the cause of high pressure, heart disease, dilation of veins and thrombosis. In general, being fat produces more than enough problems. If you want to have a long flying career, become more active, take up sports."

There is something worth pondering here. Recently the captain had started feeling sluggish and sleepy, and he noticed that it was harder for him to withstand accelerations during piloting maneuvers. He had an inkling that his getting fat was the cause. But he did not want to admit this to himself. It seemed to him that his growing bulk imparted to him a sense of solidity and authority. This is a common misconception.

As the physician validly noted, the main cause of fat deposition is low motor activity and too many calories in the diet. The weight of a healthy person depends directly on the energy intake relative to energy expenditure. But research has established that an inactive way of life has a greater influence on growth in excess weight than does a diet that exceeds the calorie requirement of the body. Observations have shown that given identical food intake, pilots carrying excess weight move about much less in their day-to-day life than do those with close to normal weight.

Weight gain may be prevented by physical exercise. This is especially noticeable when the claorie content of the diet does not exceed the total energy outlays during physical training and the energy the body requires for metabolic processes. The following examples attest to this: The amount of stored fat in light athletes training for endurance is low, while that in heavy athletes is normal even if they are heavy. We can add to this that stored fat is lower in physically fit pilots than in insufficiently fit pilots. In this case an active physical load basically does not cause an increase in food consumption.

According to modern medicine there are a number of advantages of physical training over dietary restrictions: As a rule, weight loss resulting from a diet involves significant protein losses from the body, while the weight loss associated with physical training is exclusively a function of a decrease in stored fat; physical training also improves the function of the cardiovascular system and muscles; physical exercises provide a certain emotional outlet. It is emphasized in this case that the most significant impact may be achieved by combining physical training with a restricted diet.

The most preferable physical pursuits are walking, jogging and sports that require the subject to be active. But it should be remembered that weight reduction with the help of physical exercise is a gradual process, and therefore the training must be conducted regularly.

Because the total weekly calorie intake of a pilot is constant, it would be suitable to orient himself on the size of the physical load. To determine what it must be and how long the pilot should train to bring his weight down to normal, he must know his body weight, his approximate energy expenditure in calories when performing prescribed physical exercises and the desired weight loss per week. These data can be obtained from Table 1, which considers several forms of sports.

Table 1. Approximate Energy Expenditures for Different Forms of Activity

Form of Activity	Energy Outlays, kcal/hr per kg body weight
Walking at a speed of 3.7 km/hr	3.08
Playing volleyball (at the beginning of training)	3.08
Playing table tennis	3.43
Swimming a backstroke at a speed of 25 m/min	3.43
Swimming a breaststroke at a speed of 20 m/min	4.22
Riding a bicycle slowly on a level road	4.65
Walking at a speed of 7.2 km/hr	5.81
Playing tennis	6.07
Playing basketball	6.20
Swimming freestyle at a speed of 40 m/min	7.66
Swimming a breaststroke at a speed of 35 m/min	8.44
Playing handball	9.11
Running	13.20

Table 2. Weight Assessment Depending on Height and Age

Height, cm	Age						
	20—25	26—30	31—35	36—40	41—45	46—50	51—55
155	57,0 / 62,7	59,0 / 64,9	60,0 / 66,0	61,0 / 67,4	62,0 / 68,2	62,0 / 68,2	61,0 / 67,1
160	61,6 / 67,1	62,0 / 68,2	63,0 / 69,3	64,0 / 70,4	65,0 / 71,5	66,0 / 72,6	66,0 / 72,6
165	65,0 / 71,5	66,0 / 72,6	67,0 / 73,7	68,0 / 74,8	69,0 / 75,9	70,0 / 77,0	70,0 / 77,0
170	69,0 / 75,9	70,0 / 77,0	71,0 / 78,1	72,0 / 79,2	73,0 / 80,3	74,0 / 81,4	74,0 / 81,4
175	73,0 / 80,3	74,0 / 81,4	75,0 / 82,5	76,0 / 83,6	77,0 / 84,7	78,0 / 85,8	79,0 / 86,9
180	77,0 / 84,7	78,0 / 84,8	79,0 / 86,9	80,0 / 88,0	81,0 / 89,1	82,0 / 90,2	83,0 / 91,3
185	81,0 / 89,1	82,0 / 90,2	83,0 / 91,3	83,0 / 91,3	84,0 / 92,4	85,0 / 93,5	87,0 / 94,7

-Experience has shown that a person can lose about 388 grams per week without any health impairment. This is equivalent to 3,500 kilocalories (it would be unsuitable to attempt faster weight loss). As an example a pilot weighing 109 kilograms decided to reduce 388 grams per week through physical training. For this purpose he selected daily slow bicycle riding on a level road for an hour. Using the table, he calculated that he expends 500 kilocalories per hour (4.56×109) and 3,500 kilocalories per week (500×7) which is what he had to do. As a result of persistent exercising the pilot lost extra weight, which had an immediate effect on the way he felt.

Using the table, we can calculate different forms of physical activity in the course of a day and in subsequent days of the week. For example we can plan 30 minutes of walking or 30 minutes of swimming and different combinations of exercises carried out at different times of the day. Concurrently we must make sure that the daily energy expenditures are equal to the planned expenditures (500 kilocalories for example).

Table 2, which was compiled using A. Pokrovskiy's procedure, can help us determine normal weight (the numerator indicates the optimum weight, and the denominator shows the maximum permissible weight, beyond which first-degree fat deposition begins). It is presumed that fat deposition does not occur when the optimum weight is exceeded by up to 10 percent without disturbing metabolism. First-degree fat deposition occurs when the optimum weight is exceeded by 10-30 percent, second-degree deposition occurs at 31-50 percent, and third-degree deposition occurs at 51-100 percent.

We should note in conclusion that on initiating his physical exercise, the pilot must consider what his most acceptable load is, his functional state and his age. It would be best to begin by reducing 200-300 grams per week, which would require the pilot to take up walking, running, swimming or bicycling.

The forms of physical activity suggested here are accessible to all. It would be suitable to include them in the daily routine irrespective of how busy the individual may be. As a result his health would win out, and his efficiency would increase.

11004
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AIRCRAFT MAINTENANCE DURING SPRING FLIGHT TRAINING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) p 33

[Article by Engr-Lt Col V. Begeka, regiment deputy commander for air engineer service: "In an Intense Rhythm"]

[Text] The success of air warriors in the sky depends on more than just the personal training of crew commanders. It also depends on the proficiency of specialists of the air engineer service and on their selflessness, diligence and initiative.

Most of our unit's engineers and technicians possess enviable diligence and inexhaustible energy, and they are persistent in working toward their goals. Among them, I would distinguish Officer M. Strikan first. There is an "Outstanding" emblem on the fuselage of his airplane. The specialist has deeply studied all of the systems of the warplane, and he knows how to aim for high results in every flight shift.

Many years have passed since Strikan graduated from military school. But the officer continues to be just as persistent in his technical training and in improving his habits. This is why he never makes mistakes in servicing the airplane. He is especially attentive at this moment, in this transitory operating period between spring and summer.

This period has its unique features, ones which must be accounted for by personnel of the air engineer service. Our part of the country is typified by unstable weather and tangible variations in pressure and temperature. This has a significant influence on the operation of aviation equipment. Sharp changes in air temperature, humidity, solar activity, precipitation, the strength of the earth on which the airfield is located and the dust content of the air around the airfield all add complexity to the work of specialists of the air engineer service, requiring exceptionally high organization and diligence from them, and strict control over the quality of jobs done on airplanes and precise compliance with the requirements of the instructions and manuals from air engineer service executives. Otherwise disappointing mistakes can arise.

Once during take-off a pilot was unable to turn on the afterburner of his left engine. It turned out that the pin on the plug connection of one of the

machine units had rusted over due to moisture getting into the airplane compartment. Similar incidents also occurred aboard some other craft. Without a doubt the personnel of the air engineer service are directly or indirectly at fault for such problems.

Usually more problems of various kinds arise in the spring-summer period. Many of them arise owing to the unfavorable influence of unstable weather. But some arise at the fault of the airmen. Thus the landing gear of one of the fighters would not come up after take-off. After using up the established fuel norm the pilot landed the airplane at his own airfield. Making a careful inspection of the craft, the engineers discovered that the emergency landing gear release lever was unsecured and shifted forward a third of its stroke. The resulting opening of the emergency landing gear release cock caused one of the valves to operate. The latter is what kept the pilot from taking up the landing gear after take-off. Those at fault for the incident included aircraft technician Senior Lieutenant V. Alimov, acting flight technical maintenance unit chief Officer A. Petrov and pilot Captain G. Stepin, who failed to notice that the unsecured emergency landing gear release lever was not in its proper place.

This case was a serious lesson to us. First of all we demanded that the squadron deputy commanders for air engineer service, the flight technical maintenance unit chief and the maintenance groups chiefs raise their production discipline during the different forms of preparation of aviation equipment and its specific inspections.

Experience has shown that when work is well organized, when every specialist is conscientious and when the requirements of the instructions and manuals are complied with strictly, such shortcomings may be avoided. This is promoted in many ways by special training, by technical training sessions, and of course by the competition for outstanding airplanes. We are implementing such measures not only in the classrooms and on the equipment itself, but also in a well outfitted planning office. It has become a unique creative laboratory for the engineers and technicians. In it, the officers analyze the mistakes made by flight crews and air engineer service specialists, they generalize the experience of the best workers, and they draw up the appropriate documents. The most effective methods of making preliminary and preflight preparations of aviation equipment are discussed here. The office is equipped for this purpose with graphs, diagrams, displays and plotting boards such as, for example, the "Annual Timetable for Periodic Airplane Inspections" and "Measures to Improve Dependability of Propulsion Units," and production schedules for different forms of preparation of warplanes.

The experience of our leading specialists shows that the personnel must devote more attention in spring and summer to the hydraulic systems of fighters, since that is where the possibility of problems is the greatest. This can be explained by the fact that the parts of these systems are spread over considerable areas of the airplane. Moreover thay are structurally the most complex as well. Additionally, hydraulic systems perform diverse functions, controlling various units and machine units. Dust that may penetrate, in particular, into the airplane's booster system is a serious threat to their normal operation.

Sometime when seals are broken, hydraulic pumps break down, usually owing to leakage of hydraulic fluid from beneath the covers of reciprocating parts or the delivery regulator. Consequently this equipment must be kept under strict control.

Hydraulic hoses and pipelines require special concern. Hydraulic fluid may leak from them if their sealing material breaks down as a result of delamination and cracking. Therefore the possibility of failure of the aircraft control system, jamming and excessive free play of levers and harder control are not excluded. To prevent such things from happening we organized additional lessons for the air engineer service personnel on operation of the hydraulic, fuel and other systems of the airplane in the spring-summer period, we discussed the subject matter of the training exercises once again and made it more objective, and we gave talks on the most difficult cases that had occurred in the regiment in past years.

We also devote serious attention to operation of airplane propulsion units. This brings the following incident to my mind. Once in spring a serious malfunction occurred in an engine due to the carelessness of one of the specialists of the technical maintenance unit--a foreign object entered the engine. Unfortunately, no one noticed this in time. Many bitter but just reproaches were directed toward us at that time. The specialist at fault was strictly punished. The specialist's mistake was analyzed at a conference of the officers, and then at a technical critique in the subunit.

During a recently held tactical flying conference the airmen noted concrete measures for preventing such mistakes. In particular, much attention was turned to raising the personal responsibility of each specialist for the maintenance and operation of aviation equipment in spring and summer.

The questions of the quality and effectiveness of preliminary, preflight and postflight preparation were examined at a meeting of the unit's instruction methods council. Much attention was turned to the conduct of lessons, to improving the procedures used and to raising effectiveness. This was the subject of serious discussion in the primary party organizations as well.

Having incisively evaluated the results of their labor, the personnel of the air engineer service are fully resolved to complete with high quality all tasks of the summer training period and to greet our party's 80th anniversary with worthy gains.

11004
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COMPETITION FOR 'BEST AIRCRAFT' DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 34-35

[Article by Maj Yu. Andronov: "And the Airplane Became Outstanding"]

[Text] It seems as if it was quite recently that Senior Lieutenant of Technical Service V. Rogachev's fellow servicemen adopted pledges for the competition "Raise alertness, dependably insure the motherland's safety!". And now the winter training period is approaching its home stretch. A great deal had been done in the squadron during this time. The ranks of the outstanding and classed specialists increased, and several airplanes were declared to be outstanding in a unit order. Well organized competition between soldiers, crews and squadrons played a great role in achieving the high results.

Following the November (1982) Plenum of the CPSU Central Committee the competition in the aviation collectives assumed a special content. The examples of the patriotic activity of flight crews, engineers and technicians became richer. The enthusiasm of the airmen is continually inspiring new initiatives promoting further reinforcement of the country's defense capabilities and the combat readiness of the armed forces.

I recall in this connection the participation of younger and more-experienced officers in the "Outstanding Airplane" competition. At the beginning of the training year, when the soldiers discussed the tasks posed by the commander in an open party meeting, the communists determined how to complete them in the best and most effective manner and how to reveal unutilized reserves the fastest. They drew up a plan for preparing airplanes and crews for testing. On the initiative of the communists, the airmen reviewed the pledges they had adopted earlier, and they added several new items.

A month later the progress in the outstanding airplane competition was analyzed at a regular meeting. There was more discussion of shortcomings, arguments arose, and the most effective ways of raising the combat readiness of aviation equipment were proposed. Communist officers A. Kirilin, Yu. Demchenko and V. Karyakin, the best technicians, were asked to share their experience in servicing and preparing fighters for flying. The eagerly consented, and on the following day they showed their fellow servicemen the effective methods of inspecting

units and machine units, and they explained the way to insure a long operating time for the warplanes. After that they gave a practical demonstration of their proficiency.

Time passed unnoticeably, and before long the moment came to summarize the results of the competition. It was discovered that things had not been all that simple for the young technicians and mechanics. The terms of the competition were so stiff that some specialists began to fear that it would be very difficult to fulfill all of the items of the pledges and the terms of the competition.

"We have all the possibilities," said the squadron commander at a subsequent critique, "to win the competition for outstanding aircraft. It is important for each individual to tackle completion of this serious and necessary task responsibly."

The commander advised the experienced technicians to help the young. The words were followed by action. For example, Communist A. Kirilin, a top-class specialist, had many interesting suggestions for Officer A. Igoshev. Their aircraft are parked next to each other on the pad. The officers went over the requirements of the unified regulations governing equipment operation, the manuals, the instructions and the bulletins together. Kirilin served as an example of swiftness and accuracy in his work. During preliminary preparations for flying and during down days the airmen checked out each part of the onboard systems and predicted malfunctions in the machine units together. They were provided considerable assistance by the subunit deputy commander for air engineer service and by the squadron's party organization.

The time finally came when Senior Lieutenant of Technical Service A. Igoshev reported to the commander that he was ready to present his aircraft to the commission. This was the first challenge and the first serious victory of the young technician in fulfilling the terms of the "Outstanding Airplane" competition. But we must always move forward, we must always achieve more. The commander and the communists of the squadron continued to be obsessed by the same thought: How could they make a few more airplanes outstanding? The squadron commander expressed his ideas on this account to the secretary of the subunit's party organization. They decided together to discuss this with the communists. The agenda for the next party meeting was titled: "Responsibility of Party Members and Candidates for Exemplary Maintenance of Aviation Equipment and Intensification of the Effectiveness of the Fight for Outstanding Airplanes."

The commander gave a report at the meeting. He analyzed the successes and mistakes of each pilot, technician and mechanic, and he offered recommendations on how a few more airplanes could be raised to high combat readiness.

The chief of a flight technical maintenance unit expressed serious concern over the maintenance of an outstanding airplane assigned to Officer V. Aleksandrov. Within a short period the craft suffered delays in taking off twice at the fault of the technician and the mechanic, who maintained and prepared the airplane for flight negligently and who deviated from the requirements of production discipline.

The meeting was business-like. The highly active participation of communists distinguished it. A speech given by Officer Yu. Demchenko was especially memorable. The leading specialist described the difficulties that must be surmounted in the fight for an outstanding airplane, he gave ideas on how to organize work more efficiently during days of preliminary and preflight preparations, and he pointed out what requires the most persistent attention during maintenance of aviation equipment.

Communists V. Karyakin, A. Kirilin and others gave interesting recommendations in their speeches. Each of them pledged to apply maximum effort to win the outstanding title for their airplanes, and to climb to a new level of military maturity in the competition.

The initiative of the squadron communists was approved and supported by the command and party organization of the regiment. To publicize the achievements of the leaders in the unit, a technical conference was conducted on the topic "Exemplary Maintenance of an Airplane--A Guarantee of Flight Safety." A report given by the deputy commander for air engineer service was followed at this conference by a substantial communication offered by specialist 1st class Officer A. Kirilin, whose experience had recently been generalized and disseminated among the subunits by active party members. The achievements of Kirilin and other members of the leading crew were described in the next radio news broadcast and a combat bulletin.

Engineer-Lieutenant V. Karpov labored conscientiously in the days of preparation for the technical conference. He acquainted himself with the work of many aviation specialists who excelled in training, and then with the help of Senior Lieutenant of Technical Service V. Karyakin he organized an exchange of the best experience in the subunit. Being top-class specialists, the airplane technicians and mechanics not only described the most sensible methods of operating the onboard systems to their comrades, but they also used the actual equipment to demonstrate how to perform certain operations with high quality and within the prescribed time, and they explained what should receive priority attention in the maintenance of airplanes in early spring, when temperature changes are especially tangible.

It should be noted that the technicians of the outstanding airplanes are still devoting considerable effort to exemplary maintenance of their warplanes.

They also managed to encourage other specialists to join the competition for raising class qualifications and labor excellence and for strict compliance with requirements imposed on an outstanding airplane. Specialists of the maintenance groups and the technical maintenance units are actively participating in this competition as well. After all, it has long been realized that if an airplane that has undergone repairs enters the squadron in exemplary condition, it must be maintained in this same condition constantly.

It stands to reason that the success in encouraging airmen to fight for increasing the number of outstanding airplanes and the intensity of this fight depend to a decisive degree on the effectiveness with which the competition is

managed, on its organization. And when the achievements of the leaders are not placed into full view, when pledge fulfillment is not monitored, and when results are not visible and comparable, it is difficult to expect high indicators.

To the crews, outstanding airplanes are not a goal unto itself but a means for raising combat readiness. After all, if we are to maintain an aircraft in exemplary condition, we must know all of its unique features and "whims." There is no way to do without assimilating associated specialties in this regard. And once again, a socialist competition offers a broad area for activity in this issue. Experience has shown that wherever specialists of the air engineer service have the top class qualifications and wherever each soldier treasures the honor of the crew and the subunit, the successes in training and service are higher and the specialists make fewer errors in operating the aviation equipment.

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AIRCRAFT ENGINEER TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 36-37

[Article by Engr-Col A. Zotov, department chief, Tambov Higher Military Aviation Engineering School imeni F. E. Dzerzhinskiy, docent, candidate of technical sciences: "A Nose for the New"]

[Text] What is the best way to prepare a future aviation engineer? What must be done to shape and improve him as both a specialist and a leader? To what should we devote more attention in the training--to theory, to practice or to both? These questions are constantly in the center of attention of the department chairmen and instructors of the Tambov Higher Military Aviation Engineering School imeni F. E. Dzerzhinskiy. There is a constant search going on for the most effective methods of cadet training, and everything that is new and progressive is being actively introduced into the multifaceted process of training future aviation engineers.

As we know, engineers must solve many complex problems in the line unit. Very much depends on his knowledge, erudition, his intelligence and his ability to quickly detect particular faults in an aircraft system. This is true primarily of the dependability coefficients of aircraft electronic equipment and other systems.

Production training offers many useful things for cadets. It is conducted in the first years. Its purpose is to reinforce the theoretical knowledge of the students and to help them acquire the habits of fulfilling the basic production operations associated with manufacturing apparatus intended for modern aviation complexes. Production training is conducted as a rule at industrial enterprises, where cadets are offered a possibility for manufacturing some radio components, tube-type and semiconductor components, microcircuits and integrated circuits, and for taking part in assembly of electronic apparatus.

Cadets of our faculty have now been undergoing production training at industrial production associations in the discipline "Electronic Instruments and Components of Aviation Radiotechnical Devices" for several years. Working in a particular shop, the future aviation engineers assimilate its equipment and gear, and they study the chemical and physical properties of materials used to manufacture radiotechnical components. The range of production operations performed in

the approved procedures is rather broad. After a short period in which the cadets are introduced to the production rhythm, they successfully learn the simplest operations of producing components for electronic equipment: They manufacture the foundations of the components and apply their working layers, they assemble and age the instruments, they seal them off, they monitor their parameters, they test their dependability, they draw up the technical and testing documents, and they submit their products to the technical control section. All of this expands the engineering horizons of the cadets.

Development and production of integrated microcircuits--functionally complete and structurally standardized blocks and units broadly employed in the production of various electronic apparatus--is the greatest achievement of modern electronics. They are gradually displacing conventional electronic blocks and units made from discrete radio parts. The increasingly greater use of microelectronic resources may be quite aptly expressed by the formula: from integration of circuits to integration of apparatus. Therefore specialists undergoing training in electronic apparatus must study the procedures for making the basic kinds of integrated microcircuits: hybrid integrated microcircuits, large integrated circuits, large hybrid integrated circuits and microassemblies. A knowledge of the production procedures is necessary to an individual wishing to understand the basic ways of designing electronic apparatus. This understanding will become useful to future engineers as early as in their diploma projects.

Also important is an understanding of the significance of the products manufactured by the enterprise to the national economy and an acquaintance with the organization of its work. This will help future engineers to establish proper mutual relationships with enterprises supplying their products.

The production training program consists of three sections. The first includes the subjects "The Production Enterprise and Its Significance to the National Economy" and "Operation. Vacuum Tube Hygiene. Accident Prevention." The subjects of the second section include "The Work of the Process Engineer's and Chief Designer's Divisions" and "Activities of the Economic Planning Division, the Division for Scientific Organization of Labor and the Client." And finally, the third section includes "Manufacture of Passive Radio Components, Vacuum-Tube and Semiconductor Instruments, Microcircuits and Integrated Circuits" and "Assembly and Adjustment of Electronic Apparatus."

Such a saturated program naturally requires a great deal of organization. We send a copy of the practical training program to the enterprise well beforehand, so that the technical training division (or bureau) would have a possibility for selecting the most experienced instructors for the lessons. As a rule the lectures are given in the appropriate sections of the program by the chiefs of the corresponding divisions and services, or by the best-trained specialists of the shops.

The practical training consists mainly of training in production operations. The cadets perform them first under the supervision of a foreman, and then independently. A short specialized lecture course (6-8 hours) is foreseen for the purposes of achieving fast assimilation of the production operations.

These lectures are given at a high engineering and methodological level by engineers Ye. Fedosov, G. Makarova and M. Rastegayeva. Their talks are attended by the cadets with great interest.

As we know, there are many different kinds of operations involved in the production of electronic equipment: soldering, winding, fastening and so on. The aggregate of these highly simple operations make up the foundation representing the initial phase of the cadet's participation in production practice. The next is more complex--measurement of electric parameters, the tuning and adjustment of apparatus and others. Finally, the most critical phase--checking for electric faults in individual items not satisfying the required characteristics. Not every cadet is able to complete all jobs successfully. They are within the means of only those who are well trained. Nonetheless every one of them undergoes a real school of production. The advice of mentors, their abilities and their personal example have great significance. The cadets gratefully recall their masters.

During production training the cadets fulfill individual assignments requiring independent work in depth on particular questions. The cadets use the plant's technical literature, and they receive advice from experienced specialists. Practice has shown that about a third of the individual assignments terminate with submission of efficiency proposals. As an example cadets S. Selivanov, Yu. Popov, Yu. Shcherbinin, V. Tumakayev and Yu. Sdobnikov developed some original tools. Some of them have already been introduced. It is with a sense of high responsibility that cadets of the subunits in which officers A. Shevchuk and V. Sytyy serve fulfilled their assignment in the last production training session. Cadets V. Sedoy, Yu. Laminskiy, I. Filatov and others submitted efficiency proposals that were the best substantiated in engineering respects.

Production training takes up a relatively short period of time. Nonetheless, the future engineers obtain extensive, systematized knowledge. This is confirmed by scientific-methodological conferences on the results of such practical training, which are held regularly in the school. The best reports prepared with the assistance of enterprise executives and the school department are discussed at these conferences as a rule. Cadets M. Ivanovskiy, G. Vasil'yev and Yu. Dement'yev gave substantial reports at one of the conferences. And a unit developed by Cadet O. Timofeyev received a high evaluation from the plant director. These reports present an analysis and a generalization of operations learned at the work station, and they contain efficiency proposals. They examine the technological possibilities of production lines, and production organization. Industrial enterprise executives often speak at the conferences. They describe the prospects for their plant's development, and they make effective and concrete proposals on expanding sponsorship and cooperation.

On days off during the period of production training the cadets work together with the industrial laborers on the kolkhoz and sovkhoz fields, and they participate in the enterprise's athletic events, its mass cultural projects and the socialist competition. The latter is organized between cadets in the subunit

in accordance with the pledges adopted in the shop. The quantity and quality of the work done, the number and value of efficiency proposals and the depth of understanding of the essence of the operations performed are adopted as the quality criteria. Competitions between the cadets and workers of a shop is a qualitatively new form. Under the guidance of experienced specialists the cadets are soon able to fulfill the work norm, and they can compete fully with young industrial laborers. The progress of the competition is efficiently publicized at the work stations and discussed at joint conferences.

The cadets undergo such practical training in different cities, and they are quartered on the territory of military units and at different schools. Competition is also organized between cadets and servicemen of these subunits.

A great deal of effort was contributed to organizing cadet production training by department officers G. Malinskiy, V. Zherdev, Yu. Taleykin and V. Pashkin, and by party and Komsomol active members. Officers A. Meshkov, A. Plotnikov, V. Ovsyannikov, A. Shevchuk and V. Sytyy approach this effort creatively and with great responsibility. Their concern for the cadets and their high exactingness make it possible to complete the practical training program in its entirety. Active Komsomol members A. Sukhoruchenkov and V. Mamontov participate actively in organizing the leisure time of the cadets.

Production training is having a significant influence in shaping the cadet as an engineer and an organizer. This is why the ways for raising its effectiveness continue to be one of our most important problems.

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PSYCHOLOGY OF HIGH-ALTITUDE BOMBER FLIGHT DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 38-39

[Article by Lt Gen Med Serv N. Rudnyy, doctor of medical sciences, professor: "Psychology of Flight Labor"]

[Text] "Flight Into the Stratosphere." Continuation. See No 3 for the start.

Lieutenant Colonel V. Solov'yev faced a complex high-altitude flight during that flying shift. There was not all that much time left before he had to take off. The aviation specialists were finishing their preparations of the bomber for take-off. They attentively completed the last inspection of the complex programmed and automatic units. The calmness and imperturbability of the pilot seemed somewhat strange on the background of their intense labor. But that is only the way it seemed. He was attentively observing the work of the engineers and technicians. Concurrently the officer thought about the forthcoming flight, considering it in all details from take-off to landing, and in his mind he analyzed the various complex situations that could be encountered in the air.

Only those who knew the pilot well understood how intense his thinking was in these critical minutes; only they could discern the maximum self-control and concentration hidden behind his outward serenity. Inspecting the aircraft and its high-altitude equipment and testing the apparatus, Solov'yev acted very efficiently and punctually, and his movements were economical and calculated. It felt from everything that the pilot was confident in himself and in the equipment, that he was psychologically mobilized, ready to meet any complication.

And such a complication did arise, virtually as if to test this preparedness of the airman. During one of the most critical phases of the flight the aircraft experienced a jolt, and unusual sounds pierced through the whine of the working engine. It took just a few seconds for the crew commander to analyze the work of the propulsion unit with his instruments and then to make a decision. The pilot continued on his assignment. He honorably extricated himself from a critical situation, having demonstrated a real example of bravery and self-control.

Every air warrior encounters surprises and experiences difficulties in similar high-altitude flights. There is nothing surprising about that: The psychological loads imposed upon the pilot rise during the time he monitors and operates the cockpit equipment, and his memory and thinking are loaded to the maximum as he analyzes the numerous data transmitted aboard the airplane.

But there are complexities of another order as well. At high altitude, in the rarefied environment, it becomes significantly more difficult to pilot the craft, and unique reations arise in the body. In stratospheric flight the pilot tries not only to counter the perturbations of the airplane but also to anticipate them, and this is not all that easy to do. The unavoidable changes in work routine lead to an increase in the number of movements, and they require expansion of attention span. It is only as the pilot becomes proficient that these movements acquire stability, and that the airman forms firm habits and develops his professional "signature."

The commanders of the best units and subunits try to make fuller use of the recommendations of military pedagogics and psychology when they analyze the high-altitude flights and actions of pilots. A deep knowledge of the psychological features of their subordinates helps executive officers to correctly determine the reasons behind mistakes and to develop the ways to prevent them. This is also very important to airmen who had not flown for a long period of time for one reason or another.

It was believed until recently that only lengthy interruptions in flying--from 30 to 45 days-- have an unfavorable influence on occupational habits. But recent research has shown that this is not so. A break of even 15-20 days, and sometimes even shorter, can have just as unfavorable an effect on the stability of flying habits. Thus when a pilot uses special high-altitude gear, which encumbers his movements to a certain extent, he may make a mistake in the performance of a stratospheric assignment even after a two-week interruption in flying.

As we know, the aerial situation often subjects crewmembers to severe tests. While the speed of flight does not have an effect on the human body, its psychological influence is highly tangible. The airman experiences an increase in excitement associated with so-called "rapture of speed." The sensation of acceleration usually influences the pilot's mind in proportion to the magnitude of the acceleration. He experiences a heavy feeling and fatigue. For a while he may experience a decrease in thinking rate, and his vision may worsen.

An important factor influencing a pilot's activity during fast high-altitude flight is the increase in the quantity of information transmitted aboard the airplane. Moreover this information must be evaluated and processed in limited time. It has been established for example that in every hour of flight at supersonic speed at high-altitude, the pilot performs six to eight times more operations of various kinds than at subsonic speed. Commanders organizing preparation of their subordinates for stratospheric flight must naturally consider this, and they should structure the training process more purposefully.

During stratospheric flight at high speed, a zone arises before the airplane in which the crew is usually unable to detect new objects, since their perception apparatus does not have enough time to react. The higher the speed, the larger is this zone. It is within this zone that airmen often make mistakes. For example they may be late in correcting for bank. It is very important for them to consider these circumstances and to be internally ready to avert mistakes in their actions. As a rule, training conducted well beforehand helps to keep mistakes from happening.

The uniqueness of piloting an airplane during the take-off run and at the "ceiling" lies not so much in the muscular and motor efforts of the pilot and the outlays of physical energy as in his ability to optimally complete his tasks in the particular situation that evolves and to promptly use his mental possibilities. This can be illustrated by the following example. As we know, introduction of automation into aircraft control systems and aircraft armament has made significant changes in flight labor, so that it is now noticeably easier. But at the same time it has been noted that the more human functions an automatic system assumes, the more complex the pilot's responses to its sudden failure become. It is at this time that the pilot's intelligence and his psychological preparedness to withstand difficulties come to the forefront.

I recall a lesson being conducted in a trainer with pilots of the squadron commanded by Lieutenant Colonel A. Volkov. On a complex tactical background, the squadron commander and the flight commanders introduced unexpected inputs to the students simulating failure of the sighting, piloting and navigation equipment. Meanwhile they attentively watched how the subordinates redistributed their attention in the extreme situation, how they used back-up devices, how they evaluated the situation and how they made decisions in different phases of interception. The lesson leaders gradually increased the pace of the training sessions with a consideration for the level of the flying habits of the air warriors, their emotional state and their psychological preparedness to act in a complex situation. The assignment was repeated for those who were unable to complete their work in the prescribed time. The effectiveness of such training turned out to be extremely high.

I once heard the following opinion: Because time is acutely short for performing various tasks aboard a modern airplane, mistakes are unavoidable. Basing myself on many years of experience, I can say that this point of view is incorrect. Combat training practice has shown that the main reason for mistakes in flight lies not in the lack of time to perform some sort of operations with cockpit equipment but in insufficient training of the airmen. He who works on himself a great deal, who hones his habits until they become automatic is able to work in the air at a high rate as a rule, and he is able to avoid mistakes even in a fast-moving situation. And on the other hand, he who is untrained makes mistakes not only if time is lacking but also when there is more than adequate time. This means that if flight crews are to act confidently, they must be highly trained in professional respects, and naturally they must exhibit high psychological maturity, which can help them to maintain their coolness, composure and judgement in an extreme situation.

The experience of air warriors who fought in the Great Patriotic War and the practical experience of retraining personnel for jet airplanes in the postwar years may be useful to commanders in this connection. In both cases the emotional factor associated with a dangerously changing situation or with the novelty of the equipment or with instrument piloting in the absence of a visible natural horizon was the main unique feature determining the activities of airmen. There is much here that is valuable and instructive, and that will help to improve the psychological maturity of air warriors and perfect their habits of flight simulation.

It should be noted that the image of a flight is acquiring increasingly greater significance to flight safety. This method helps flight crews to avoid many difficulties associated with flying in the clouds and using both main and back-up instruments, and to reduce excessive tension in maintaining spatial orientation. Airmen who do not approach simulation of their actions deeply and seriously enough often suffer failure. When flying on instruments, they experience heightened tension. There have been cases in which a pilot experiencing heightened sensitivity in his vestibular apparatus has undergone illusions associated with his position in space. The methods of fighting such phenomena must be explained to the flight crews, and they must be taught to correctly switch their attention to their piloting and navigation instruments, especially in cases where the attention is severely taxed.

It has been noted that psychological tension causes the pilot to involuntarily turn his attention from instruments to seek reference points outside the cockpit. This often happens when he descends to the lower margin of the cloud ceiling after completing a high-altitude flight. On becoming distracted from the instruments, the airmen may create an emergency situation. This is why experienced teachers form the flight model within the students while still on the ground, why they are concerned over their psychological preparedness to act in minimum weather, and why they use electronic apparatus to teach them to distribute their attention between both the instruments and the space outside the cockpit. A diffuse horizon, reduction of accomodation (the capacity of vision for adapting to objects located different distances away) and a number of other factors noticeably complicate high-altitude flight. Moreover the pilot is constantly monitoring a higher level of fuel consumption during the operation of the airplane's propulsion system in afterburner mode, the temperature of exhausts and so on. These and other circumstances make turning attention to the psychological preparedness of flight crews necessary. A knowledge of the basic laws of psychological science can help to reduce mental tension in flight.

(Conclusion follows)

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TRAINING, WORK OF LEADER OF AIR ENGINEER SERVICE GROUP DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 40-41

[Article by Col V. Lebedev: "The Art of Communication"]

[Text] "Boris Fedorovich," the party committee secretary addressed the deputy commander for air engineer service, Major of Technical Service Ivanov, "your squadron is now starting to assimilate new aircraft equipment. That's a hard thing to do. Your success will depend in many ways on you as the leader of the air engineer service."

Major Ivanov himself had some idea of the difficulties that were awaiting him, and of the amount of work that had to be done together with his subordinates. The officer tried to think out whether or not he had been able to tune the chiefs of the flight technical maintenance units, the chiefs of the service groups and the airplane technicians to the important task in terms of their psychological morale.

Communist Ivanov knew that assimilation of a new airplane possessing superior combat capabilities would have a significant effect on the squadron's combat readiness.

"Yes, Vladimir Petrovich, everything now depends on people, on their spiritual disposition, on their organization and diligence," Ivanov replied.

The conversation went on late that evening in the party committee. They discussed the new problems and argued about the best ways to solve them, all the more so because retraining is not all that frequent a phenomenon in the life of airmen. And the effectiveness of retraining and the extent to which training time could be reduced depend in many ways on the attitude of each person toward the effort, and primarily on the activity and personal example of communists. The party committee secretary liked Major Ivanov's openness, his optimism, his capability for keeping to the essentials without straying from the main point, and he liked his ability to grasp that invisible boundary in relations between people which must not be overstepped. Consider this in the light of the fact that everyone has an unrepeatable character. This is why the officer-leader is obligated to be tactful and restrained, and to manage the work without compromise and with party openness.

Tactfulness, sincerity, honesty, faultless discipline, sensitivity and responsiveness earned Boris Fedorovich respect at the Karkhov Electrotechnical Communications Tekhnikum and at the military air engineering academy, where he served as an instructor, and in the oldest higher military aviation school for pilots, in which the young specialist certified cadets for flying.

Of course, it is easier for an engineer to devote himself to engineering, to technology, and to work with complex apparatus everyday than to work with people. Managing people is hard but satisfying. When Ivanov was an aircraft technician he had to deal mainly with a warplane and several specialists. He had an outstanding knowledge of his responsibilities, and he fulfilled them conscientiously. He was often noted among the best in critiques and whenever the results of socialist competition were summarized. Ivanov was one of the first to receive the master qualification. For almost 8 years Boris Fedorovich prepared his aircraft and released it for flight, and every time he proudly observed its swift take-off, after which he anxiously awaited its return, attentively peering into the blue horizon, and then hurried toward the pilot after he landed. This leading officer serviced hundreds of sorties. He met many sunrises at the airfield, and he watched many sunsets. He worked both in the torrid heat of the steppes and in chilly winds.

Later on Ivanov was given charge of a control and inspection station in a Guards air unit. He was required to train and indoctrinate subordinates and to help them improve their occupational proficiency. He was also forced to learn the delicate and intricate art of working with people, the art of communication, all the more so because not all officer technicians received his appointment with an open mind. Some felt that a candidate for this position could have been found in their own collective.

Boris Fedorovich understood their mood, and he tried to assimilate his new job and become a full member of the collective as quickly as possible. He tried to demonstrate that he did earn his promotion. In his communication with people, he was restrained, calm and responsive. He tried to utilize every hour of working time with maximum payoff.

A nose for the new helped Ivanov to assimilate the particular features of the control and inspection station quickly, and to prepar and perform a number of orignial experiments aimed at raising the station's role in the course of operating modern aircraft. The following subsequently appeared in his personal file: "...constantly seeks innovations. He developed and introduced 10 efficiency proposals that expanded and raised the effectiveness with which the control and inspection station is used. He successfully learned a diagnostic method based on measuring vibrations of airplane and engine parts. He constantly maintains exemplary order in the control and inspection station. He devotes much attention to training and indoctrinating the aviation specialists. The lessons he gives are interesting, and they proceed at a good methodological level. Comrade Ivanov is one of the best officers in terms of introducing advanced skills, and he is an active innovator. He enjoys the great respect of all of the unit's engineers and technicians for his exceptional diligence and his conscientious attitude toward service."

After that came a new appointment.

For several years Boris Fedorovich headed a squadron air engineer service. He knew how to establish spiritual contact with people and to encourage each person's interest in military labor and in effective rivalry with comrades in arms. Otherwise it would simply be impossible to manage the activities of specialists to whom highly complex combat equipment is now entrusted. Also, there are some among the common soldiers who graduated from institutions of higher education and received an engineering diploma.

At first, things did not work out for everyone as they should. During preliminary preparations Major of Technical Service Ivanov often approached aircraft technician Engineer-Lieutenant Valeriy Khorol'skiy and said:

"I would like to look over your aircraft to see if you've done everything on it."

And then both would check out the operations that had just been completed. Boris Fedorovich had reason for checking him out: He know that Khorol'skiy was not much on production discipline, and that on occasion he lost tools. Moreover the quality of his preliminary preparations was often low. Ivanov decided to help the engineer-lieutenant to rid himself, right from the very beginning, of all that kept him from competently servicing the aircraft.

On more than one occasion the squadron deputy commander talked with the chief of the flight technical maintenance unit and gave him concrete recommendations on working with subordinates. He taught him to analyze labor quality, and he invariably recalled:

"Although young officers are diploma-carrying engineers, we must not allow their professional development to slip from our attention. We are obligated to really work with them." And he would ask in the same breath: "What are your ideas on this?"

The chief of the flight technical maintenance unit would attentively listen to all advice coming from Ivanov, and he would competently utilize his work experience in training and indoctrinating the new soldiers.

Not much later the officer began feeling that the lieutenants were warming up to him. The young officers turned to him for advice and help, and they shared his confidence.

Modern aircraft equipment and the procedures used in maintaining it are good, but there is something that is infinitely more attractive and interesting in the activity of the leader of the air engineer service. What is most valuable to Ivanov is the people of the squadron, together with their interests, needs, demands and their constant desire to develop their individuality.

Communist Senior Lieutenant of Technical Service N. Prigara is specialist 1st class. The fuselage of his airplane bears the "Outstanding" emblem. The officer was awarded the Honorary Certificate of the Komsomol Central Committee

for his successes in combat and political training. He is presently taking a correspondence course through a higher military aviation engineering school.

"Even during the time that he was preparing for his examinations Nikolay Porfir'yevich managed to find the time to visit the airplane parking pad for 2 or 3 hours," said squadron deputy commander for air engineer service Major of Technical Service Ivanov, and he emphasized in pride for his subordinate: "He would come here to work. He would equip the work station and attach inspection seals to instruments."

Communist Ivanov has devoted considerable effort to the development of each officer. They still remember in the squadron how much trouble Senior Lieutenant of Technical Service S. Novitskiy made for the executives of the air engineer service and the entire collective. He filled in documents carelessly, he stored them negligently, and he did not always observe production discipline. In a number of cases engineers making a spot inspection of his airplane left displeased with the condition of the aircraft.

Novitskiy needed help in ridding himself of these shortcomings. Boris Fedorovich decided to counsel with the chief of the flight technical maintenance unit.

"Novitskiy's lack of organization, excessive caution, introversion and somewhat mistrusting attitude toward people are making it very hard for him to get up on his feet. It looks like we'll have to work with him a great deal," said the chief of the flight technical maintenance unit.

His opinion took Ivanov aback somewhat.

"Why do you think so?" he asked.

"Do understand that I have not known Novitskiy all that long. But watching him work, I've come to the conclusion that the young officer is making his first steps way too timidly. That's why he's developing so slowly."

The squadron deputy commander for air engineer service came to realize that he would have to work with the young officers some more. He began visiting the officers' dormitory more frequently, and he took the time to learn what the young technicians did in their free time and what their interests were. Boris Fedorovich talked with Sergey Novitskiy many times, trying to offer him support, to cheer him up and to increase his self-confidence. During flying, he helped him in his work at the parking pad, and he offered recommendations. And soon he was persuaded that Novitskiy did have all the potentials for breaking himself in faster. And he did not err in his estimation of his subordinate. Time passed, and the young specialist underwent a transformation. It was evident that he was beginning to enjoy his career as an aircraft technician. And this is very important, since this encourages him to care for the aircraft, to keep it constantly ready to perform any flying assignment. Now the emblem of a high-classed specialist decorates the

officer's jacket. It is testimony to the fact that Senior Lieutenant of Technical Service S. Novitskiy had successfully assimilated operation of the new airplane.

Other airmen honorably passed the difficult examination as well, having retrained themselves for the modern aviation complex in short order. On the initiative of squadron deputy commander for air engineer service Major of Technical Service B. Ivanov and with his active participation, the experts created a good training material base; the classroom intended to provide training on the airplane and its engine was especially successful.

Boris Fedorovich and other innovators received active help from CPSU member Captain of Technical Service V. Korzhukov, who possesses a master qualification. The efficiency experts manufactured special carts that significantly eased the labor of the personnel in preparing the equipment for flying. Communist N. Andryshkin, chief of the flight technical maintenance unit, created an original tool for disassembling landing gear wheels, and he improved the fasteners used on air intake plugs.

Boris Fedorovich Ivanov is himself the author of 40 efficiency proposals. Earlier in his career, his field laboratory for instrumental control was offered at an exhibition of air force inventors. It received a high evaluation from executives of the air force air engineer service. Officer Ivanov was awarded a money prize by the air force commander in chief, Chief Marshal of Aviation P. S. Kutakhov, twice.

The squadron is now persistently fighting for new successes in training and service and in the socialist competition. A discussion on operation of the new aviation equipment was held in one of the party meetings. Squadron deputy commander for political affairs Major N. Bondarenko gave a report. The communists analyzed the achievements and shortcomings, and they planned the ways to improve operation of the warplanes. Valuable proposals directed at raising the technical excellence of the airmen were contributed by officers with master qualifications--flight technical maintenance unit chief V. Samoylenko, aircraft equipment maintenance group chief V. Leonov and others.

"New equipment also requires a new approach to indoctrinating the personnel," noted Communist Ivanov in his speech. "Many masters and specialists 1st class have been trained in the squadron. But we're still not utilizing and publicizing the experience they have accumulated in operating the complex equipment. There is a great reserve for raising the professional mastery of the soldiers in this area."

At the time this article on Communist Ivanov was being prepared for publication, I learned that Boris Fedorovich had retired into the reserves for health reasons. The airmen gave him a warm send-off. The commander presented Ivanov the "Veteran of the USSR Armed Forces" medal and an Honorary Certificate from the air force commander in chief, Chief Marshal of Aviation P. S. Kutakhov, in a solemn ceremony. Thus was marked the military labor of an officer who had served more than a quarter of a century in the Soviet Air Force.

11004
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CUBAN SPACE EFFORTS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 41-42

[Article by V. Lyndin: "Our Cuban Friends"]

[Text] The Republic of Cuba is the first socialist state in the Western Hemisphere. The banner of the revolution has been waving over the Island of Freedom for 24 years, but imperialist circles of the USA still cannot console themselves with the fact that a country in which all power belongs to the people exists at their very threshold. Various sorts of provocations against the Island of Freedom are not ceasing.

However, the Cubans are full of optimism. They are boldly attacking complex problems and developing new sectors of the national economy, ones which were simply unimaginable prior to the revolution in this country. For example a Cuban could hardly have dreamed of flying in the boundless space of the Universe! But a citizen of free Cuba, Arnal'do Tamayo Mendes [transliteration] has become the first Latin American cosmonaut. His flight with Yuriy Romanenko in September 1980 occupied a worthy place in the history of world cosmonautics.

Cuba's path into space began in 1964. Having barely risen to its feet, the young republic began systematic observation of artifical earth satellites with the assistance of specialists from the USSR, using Soviet equipment.

The Republic of Cuba is an island state. And dependable and effective channels of communication with continents have especially important significance to it. This is why the Ministry of Communications was the first state institution to begin coordinating the republic's space research efforts. The Cuban "Interkosmos" commission was initially created in this ministry, and it was not until 1974 that it was placed within the administration of the Academy of Sciences.

Cuba actively supported the idea creating the "Intersputnik" international space communication system. One of the first ground stations of the system was built in Kharuko [Transliteration] near Havana, and it was given the name "Carib."

The Carib are an Indian tribe that courageously fought for their freedom against Spanish oppressors in in the 16th century. The Caribs were defeated, but their

steadfastness astounded even the couquerors. The name of the freedom-loving tribe was given to the maritime threshold of America--the Caribbean Sea. Cuban students used this name as a symbol of their struggle for national liberation.

"Carib" station is located a few dozen kilometers from the capital, and it provides a possibility for simultaneous communication via a large number of telephone and telegraph channels. It permits radio and television exchanges with other countries as well. The station went into operation in 1973. At that time, transmission of a May Day television broadcast from Moscow initiated intercontinental space communication.

From the very beginning Cuba has been cooperating fruitfully with countries of the socialist fraternity in all directions of the "Interkosmos" program. Cuban scientists are devoting special attention to space meteorology. A ground receiving station that acquires cloud cover photographs from weather satellites has been working on the island since 1969. Another station working in the infrared range was established in 1974. Space meteorology has noticeably improved weather preditions and made it possible to develop about 20 scientific procedures used in various sectors of the national economy.

A Cuban group involved in remote sounding of the earth using aerospace resources began its work in 1977. Geographers, geologists, geodesists, physicists, engineers and agronomists were asked to take part in the research. Studies are being conducted on areas of possible mineral reserves (for example the distribution of salt domes, which are an aid in determining the locations of gas and petroleum deposits), the inner structure of mountain ranges and horizontal movements of portions of the earth's crust, the geological development of the island is being clarified, and its possible content of petroleum and gas is being evaluated. To improve predictions of sugar cane yields, plantation maps are being compiled. Environmental contamination is being monitored, soil science and geomorphological maps are being drawn up, and procedures for determining the physicochemical and biological properties of agricultural and natural objects and the characteristics of the sea surface are being developed on the basis of spectral data.

Integrated research on the possibilities of modern equipment for remote sounding of earth by means of aerospace resources was conducted in Cuba jointly with specialists from countries participating in the "Tropico" experiments of the "Interkosmos" program. The obtained results are being used successfully to study the natural resources in behalf of geology, geomorphology, hydrology, soil science, forestry, agriculture, oceanology and so on.

Cuban scientists have been working on space physics since 1967. They are conducting research primarily on the upper ionosphere and the magnetosphere of earth by radiophysical methods. In that same year a satellite tracking station built not far from the city of Santiago de Cuba began operating. It is outfitted with special telescopes and cameras that can be used to observe satellites at altitudes of up to 40,000-50,000 kilometers. In 1977 laser radar equipment was installed at the station, and it was then included in the network of laser rangefinding stations of countries participating in the "Interkosmos" program.

A unified telemetric system makes it possible for the program's participants to receive scientific information from series "Interkosmos" satallites directly on the territory of their countries. A telemetric station was established in Cuba in 1976, and it began operating with reception of information from the satellite "Interkosmos-18."

Research was started in recent years by the space physics group on crystal growth in weightlessness. This new direction was born during the time that the Cuban cosmonaut was preparing for his flight. As with previous international crews, the Soviet-Cuban crew also used the "Crystal" and "Alloy" devices to conduct a series of experiments with the general title "Carib" with the purpose of obtaining crystals of semiconductor materials. But Cuban specialists also prepared two of their own: "Sugar" and "Zone." The sucrose monocrystal was the object of their research. Work with it does not require high temperatures, and this made it possible to create transparent equipment for the experiments. The cosmonauts had the possibility for visually observing and photographing the entire course of crystal formation. Sugar is the basis of the Cuban economy, and deep study of sucrose crystal formation in different conditions is making it possible to improve the procedures of its production on earth.

Research in space biology and medicine began in Cuban 2 years prior to the flight by Yuriy Romanenko and Arnal'do Tamayo Mendes. Despite the shortness of this period, Cuban specialists were able to prepare a number of rather complex biomedical experiments for the flight. Most of them were conducted with the help of apparatus manufactured by Cuban specialists on their own or in cooperation with Soviet colleagues. One such jointly developed device was the "Cortex" apparatus intended for experimentation on the cortex (the cortex is the outer layer of the brain). It is composed of a magnetic recorder equipped with magnetic tape cassettes, a photophonostimulator, electrodes and electrode signal amplifiers. Reactions of brain bioelectric activity and evoked potentials (the brain's electric responses to various stimuli) were investigated in the experiment with the purpose of determining the wakefulness of cosmonauts and their emotional tension in real space flight.

Cuban specialists created the "Coordinograph" instrument for the "Coordination" experiment. This instrument makes it possible to objectively evaluate the dynamics of human psychomotor coordination in weightlessness. The instrument has a rigid base. A special device holds a pencil in vertical position over it. The slate pencil rests lightly on a plate to which a record sheet bearing a figure eight delimited by a double line is secured. The plate is moved forward and backward and left and right by two knobs on the front and side of the instrument. Turning both knobs, the cosmonaut moves the pencil along the entire figure between the two parallel lines; the line he draws must not touch the delimiting lines, nor must it stray beyond them. The obtained information makes it possible to evaluate the capability the body has for adapting to weightlessness.

The conditions of space flight may elicit changes in the receptor apparatus and in the state of sensory functions, and as a consequence they can have an effect on specific capabilities and habits of the cosmonaut. Measurement of sensory functions by psychoneurological methods may provide valuable information with which to evaluate and predict the performance of cosmonauts. Cuban specialists

prepared the "Perception" experiment, for which they created the "Contact" complex. It includes the "Sthesiometer" and "Leman" instruments, devices to determine distances, resistance to geometric visual illusion and active visual perception, and an assortment of balls of varying volume and identical weight. The "Sthesiometer" instrument is used to determine tactical sensitivity, while the "Leman" instrument is used to analyze the capability for dividing the distance between two parallel lines.

Cuban scientists proposed a new object for biological research--yeast. Yeasts are unicellular organisms with a short life cycle making it possible to study the life of several generations developing in weightlessness even within a short flight. The choice did not fall on yeasts by accident. Production of alcohol by fermentation and of forage to be used as livestock feed has been developed well in the republic. Yeast is used extensively in the processes. This is why the experiments "Atuey" and "Mul'tiplikator" [transliterations], of such great interests to Cuban specialists, were conducted.

Two months after the flight of the Soviet-Cuban crew, the spacecraft "Soyuz T-3" was launched. Equipment for the "Hologram" experiment developed in the USSR and Cuba was delivered to the station "Salyut-6." Cosmonauts L. Kizim, O. Makarov and G. Strekalov tested the unique equipment and transmitted the first holograms to earth from orbit. This had never happened before in the history of cosmonautics. The experiment "Hologram" was also included in the program of the Soviet-Mongolian flight.

The astounding changes that occurred on the Island of Freedom following the peoples revolution raised the republic literally to cosmic heights. The scientists and specialists of this country--the sole representative of the Western Hemisphere in "Interkosmos"--are making a worthy contribution to the vast program of space research being conducted by countries of the socialist fraternity.

11004
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COMMUNICATION SATELLITES AND LAW DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83) pp 44-45

[Article by A. Terekhov: "Space Television and Law"]

[Text] High up in space, a retransmitter satellite "hovers" several thousand kilometers above the surface of the earth. You turn on your television set, and an image transmitted from a studio located, say, on another continent, flashes on the screen. What sort of broadcasts await you? An objective chronicle of international events or misinformation enriched with open slander of real socialism? A stage concert given by real masters of culture, or a miserable film containing a dozen murders and propagandizing the cult of violence? A soccer match between popular teams, or the lurid adventures of some Western movie star?

As space technology develops, direct television broadcasting from the studio to a satellite to the home television set is becoming a reality. It can promote either expansion of cultural exchange and further convergence of the peoples of the globe, or their drifting away from one another.

Striving to preclude the possibility of undesirable development of events, the Soviet Union has initiated development of rules of international law defining the rights and responsibilities of states associated with satellite television broadcasting. In August 1972 USSR Minister of Foreign Affairs A. A. Gromyko sent a letter to the U.N. secretary general proposing inclusion of this item in the agenda for the United Nations 27th Session. The Soviet proposal was approved, and the U.N. Committee on the Peaceful Uses of Outer Space was instructed to determine the principles regulating the activities of states in direct television broadcasting.

This effort turned out to be lengthy and complex. The reason for this was the position of the United States of America, which opposed international legal regulation in this area from the very beginning, inasmuch as in this country's opinion it undermines the principle of "freedom of information."

Surmounting the resistance of the USA and its closest allies, representatives of the USSR and of other socialist and developing countries persistently directed the work as far as development of international rules of law regulating activities associated with direct television broadcasting.

Agreement was reached on a number of principles with great difficulty, on the basis of mutual concessions and compromises. Essentially disagreement remained only on one principle. But it did have key significance. According to it, broadcasts to a foreign state may be made only on the basis of treaties or agreements--that is, on the basis of the clearly expressed consent of this state.

Offering various demogogical excuses, and at times openly abusing the procedure of unanimous decision making adopted by the U.N. Space Committee, representatives of the USA blocked the effort to reach agreement on this principle almost single-handedly for a long period of time, and thus they blocked completion of the effort in general.

Considering that due to the USA's position the Space Committee cannot complete its work on the principles of direct television broadcasting, under these conditions a group of developing countries submitted the draft resolution "Principles to be Followed by States Using Artificial Earth Satellites for Direct Television Broadcasting" to the 37th Session of the U.N. General Assembly. On 10 December 1982 the resolution was adopted by an overwhelming majority of the votes. Only the USA and some of its closest allies voted in opposition.

The adopted document is an affirmation of the principle upon which the Soviet Union insisted: A foreign state may be subjected to direct television broadcasting only on the basis of treaties or agreements with it. The document contains important provisions requiring consideration of the sovereign rights of states and the compatibility of activities in direct television broadcasting with development of mutual understanding and reinforcement of friendly relations and cooperation between all states and peoples in the interests of supporting international peace and security. Among the principles approved by the General Assembly were that international law, including the U.N. Charter, is applicable to direct television broadcasting, that states are responsible for activities in direct television broadcasting, that arising disputes must be subjected to peaceful resolution and others.

Adoption of this document regulating the use of artificial earth satellites for direct television broadcasting--a unique code of space television--was an important contribution to strengthening law and order and to further developing international space law.

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TABLE OF SOVIET SPACE LAUNCHES FOR 1982

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 4, Apr 83 (signed to press 4 Mar 83 pp 46-47

[Text] "Kosmos"--series of artificial earth satellites launched regularly by the Soviet Union (beginning on 16 March 1962) by various launch vehicles from several spaceports to explore outer space and the upper layers of the atmosphere. The scientific program foresees investigation of the concentration of charged particles, corpuscular flows, radio wave propagation, the earth's radiation belt, solar emissions, meteor composition and the cloud systems of earth atmosphere, and perfection of many spacecraft design elements.

"Ekran"--television broadcasting satellite with an onboard retransmitting apparatus capable of transmitting Central Television programs in the decimeter waveband to a network of shared receivers. The satellite bears the international registry code name "Statsionar-T."

"Molniya-1"--communication satellite supporting operation of a long-distance telephone and telegraph radio communication system and transmission of USSR Central Television programs to points of the "Orbita" network in the Far North, Siberia, Far East and Central Asia. Subsequent modernization of the "Molniya-1" artificial earth satellite led to the creation of the "Molniya-2" and "Molniya-3" satellites. In particular, the latter make use of a higher frequency range (4-6 billion Hz) permitting an increase in the number of telephone and telegraph communication channels by several orders of magnitude. This also made it possible to raise the quality of television images.

"Gorizont"--communication satellite with improved multibarreled onboard retransmitting apparatus intended to support telephone and telegraph radio communication and transmission of television programs.

"Meteor-2"--meteorological satellite carrying a complex of apparatus intended for acquisition of global images of cloud cover and underlying surface in the visible and infrared portions of the spectrum, both in storage mode and in direct transmission mode, and radiometric apparatus for continuous observations of flows of penetrating radiation in near-earth outer space.

"Salyut-7"--orbiting scientific station. The purpose of the launch was to continue scientific-technical research and experiments conducted by Soviet

(1) Дата запусков	(2) Название аппарата	(3) Начальный период обращения, мин	(4) Высота орбиты (5) в апогее, км	(4) Высота орбиты (6) в перигее, км	(7) Наклонение орбиты, град
7 января (8)	«Космос-1331» (9)	100,7	819	776	74
12 января	«Космос-1332»	89,1	275	218	82,3
14 января	«Космос-1333»	105	1029	989	82,9
20 января	«Космос-1334»	89,4	315	206	72,9
29 января	«Космос-1335»	94,7	535	487	74
30 января	«Космос-1336»	89,8	379	179	70,4
5 февраля (10)	«Экран» (11)	23 ч (12) 49 мин (13)	35 658		0,4
11 февраля (14)	«Космос-1337» (15)	93,3	456	436	65
16 февраля	«Космос-1338»	90,2	393	208	72
18 февраля	«Космос-1339»	104,8	1029	975	82,9
19 февраля	«Космос-1340»	97,6	679	636	81,2
26 февраля	«Молния-1» (16)	12 ч 15 мин	40 765 в Северном полушарии (17)	490 в Южном полушарии (18)	62,8
3 марта (19)	«Космос-1341»	11 ч 49 мин	40 165	614	62,8
5 марта	«Космос-1342»	89,5	326	207	72,9
15 марта	«Горизонт» (20)	24 ч 23 мин	36 320		0,7
17 марта	«Космос-1343»	89,4	314	208	72,9
24 марта	«Молния-3»	12 ч 16 мин	40 615 в Северном полушарии	656 в Южном полушарии	62,9
24 марта	«Космос-1344»	105	1023	987	82,9
25 марта	«Метеор-2» (21)	104,2	976	954	82,5
31 марта	«Космос-1345»	95,2	550	507	74
31 марта	«Космос-1346»	97,6	675	623	81
2 апреля (22)	«Космос-1347»	89,7	364	181	70,4
7 апреля	«Космос-1348»	11 ч 49 мин	39 342	613	62,8
8 апреля	«Космос-1349»	105	1025	984	83
15 апреля	«Космос-1350»	89,8	380	181	67,2
19 апреля	«Салют-7» (23)	89,2	278	219	51,6
21 апреля	«Космос-1351»	93,5	555	349	50,7
21 апреля	«Космос-1352»	90,2	383	216	70,4
23 апреля	«Космос-1353»	89,1	269	218	82,3
28 апреля	«Космос-1354»	101	829	795	74
29 апреля	«Космос-1355»	93,3	459	438	65,1
5 мая (24)	«Космос-1356»	97,6	684	632	81,2
6 мая	«Космос-1357» — «Космос-1364»	115,4	1520	1449	74
13 мая	«Союз Т-5» (25)	89,2	278	219	51,6
14 мая	«Космос-1365»	89,6	276	259	65
17 мая	«Искра-2» (26)	91,3	357	342	51,6
18 мая	«Космос-1366»	23 ч 57 мин	35 820		1,5
20 мая	«Космос-1367»	11 ч 49 мин	39 530	612	62,8
21 мая	«Космос-1368»	90	365	218	70,4
23 мая	«Прогресс-13» (27)	88,9	278	191	51,6
25 мая	«Космос-1369»	89,4	296	229	82,3
28 мая	«Космос-1370»	89,2	290	203	64,9
29 мая	«Молния-1»	12 ч 16 мин	40 633 в Северном полушарии	653 в Южном полушарии	62,8
1 июня (28)	«Космос-1371»	101	833	793	74,1
1 июня	«Космос-1372»	89,6	277	258	65
2 июня	«Космос-1373»	90,1	368	217	70,4
4 июня	«Космос-1374»	—	225		50,7
6 июня	«Космос-1375»	105	1021	990	65,9
8 июня	«Космос-1376»	89,2	274	227	82,3

Key:
1. Launch date
2. Spacecraft
3. Initial period of orbit, min
4. Orbit height
5. Apogee, km
6. Perigee, km
7. Orbit tilt, degrees
8. January
9. Kosmos
10. February
11. Ekran
12. hr
13. min
14. February
15. Kosmos
16. Molniya
17. In Northern Hemisphere
18. In Southern Hemisphere
19. March
20. Gorizont
21. Meteor
22. April
23. Salyut
24. May
25. Soyuz
26. Iskra
27. Progress
28. June

manned complexes in the interests of science and the national economy. Improved systems and apparatus of orbiting stations were debugged during the flight. In 1982 the station was manned by a main crew consisting of cosmonauts A. Berezovoy and V. Lebedev and two visiting expeditions (B. Dzhanibekov, A. Ivanchenkov and Zhan-Lu Kret'yen; L. Popov, A. Serebrov and S. Savitskaya).

The satellites "Kosmos-1357"-"Kosmos-1364" were launched into orbit by a single launch vehicle.

"Soyuz T-5"--The spacecraft that delivered the first main crew, consisting of A. Berezovoy and V. Lebedev, to the station. On 14 May the spacecraft docked with the "Salyut-7" station. On 30 July A. Berezovoy and V. Lebedev performed extravehicular activity. The crew performed operations new to spaceflight practice: The small artificial earth satellites "Iskra-2" and "Iskra-3" intended for amateur radio communication were launched into space from the station's airlock. Following the longest manned flight in the history of cosmonautics, 211 days, on 10 December the crew returned to earth aboard "Soyuz T-7."

"Iskra-2"--small artificial earth satellite designed by the student design office of the Moscow Aviation Institution imeni Sergo Ordzhonikidze with the participation of the country's young scientists and amateur radio operators. On 17 May the satellite was separated from the "Salyut-7"-"Soyuz T-5" orbiting complex.

"Progress-13"--Automatic cargo craft that delivered expendable materials and various cargo to the orbiting station. It docked with the orbiting complex on 25 May. On 4 June the cargo craft was separated from the orbiting complex, and on 6 June it terminated its flight.

"Soyuz T-6"--spacecraft with an international crew consisting of V. Dzhanibekov, A. Ivanchenkov and Zhan-Lu Kret'yen. Following a successful program of joint research and experimentation aboard the orbiting complex, on 2 July the crew returned to earth.

"Progress-14"--automatic cargo craft that delivered expendable materials and various cargo to the orbiting station. It docked with the orbiting complex "Salyut-7"-"Soyuz T-5" on 12 July. The craft separated from the complex on 11 August, and on 13 August the craft's flight was terminated.

The satellites "Cosmos-1388"-"Cosmos-1395" were inserted into orbit by a single launch vehicle.

"Soyuz T-7"--the spacecraft that delivered a visiting crew consisting of L. Popov, A. Serebrov and S. Savitskaya to the orbiting complex. The craft docked with the orbiting complex on 20 August. On 27 August, following completion of the program of research and experimentation, the crew returned to earth aboard the spacecraft "Soyuz T-5."

"Progress-15"--automatic cargo craft that delivered expendable materials and various cargo to the orbiting station. It docked with the orbiting complex

(1) Дата запусков	(2) Название аппарата	(3) Начальный период обращения, мин	(4) Высота орбиты		(7) Наклонение орбиты, град
			(5) в апогее, км	(6) в перигее, км	
8 июня (8)	(9) «Космос-1377»	89,7	362	179	64,9
10 июня	«Космос-1378»	97,8	682	648	82,5
18 июня	«Космос-1379»	100,3	1027	552	65,8
18 июня	«Космос-1380»	93,1	732	156	82,9
18 июня	«Космос-1381»	90,3	395	216	70,4
24 июня	«Союз Т-6» (10)				
25 июня	«Космос-1382»	11 ч (11) 49 мин (12)	39 540	614	62,8
30 июня	«Космос-1383»	105,4	1041	1004	83
30 июня	«Космос-1384»	89,8	381	181	67,1
6 июля	«Космос-1385»	88,7	264	197	82,3
7 июля	«Космос-1386»	104,6	1010	965	83
10 июля (13)	«Прогресс-14» (14)	88,7	258	192	51,6
13 июля	«Космос-1387»	89,1	271	219	82,3
21 июля	«Молния-1» (15)	11 ч 41 мин	38 900	650	63
21 июля	«Космос-1388» — «Космос-1395»	115,3	1515	1448	74
27 июля	«Космос-1396»	89,5	323	208	72,9
29 июля	«Космос-1397»	93,4	549	346	50,7
3 августа (16)	«Космос-1398»	89	262	225	82,3
4 августа	«Космос-1399»	89,7	371	179	64,9
5 августа	«Космос-1400»	97,6	675	631	81,2
19 августа	«Союз Т-7» (17)	89,5	280	228	51,6
20 августа	«Космос-1401»	89,3	282	226	82,3
27 августа	«Молния-3»	12 ч 16 мин	40 814	494	62,8
30 августа	«Космос-1402»	89,6	279	254	65
1 сентября	«Космос-1403»	90,2	380	216	70,4
1 сентября	«Космос-1404»	90,2	394	211	72,9
4 сентября	«Космос-1405»	93,3	456	438	65
8 сентября	«Космос-1406»	89	253	222	82,3
15 сентября	«Космос-1407»	89,7	364	181	67,2
16 сентября	«Космос-1408»	97,8	679	645	82,5
16 сентября (18)	«Экран» (19)	23 ч 46 мин	35 580		0,3
18 сентября	«Прогресс-15»	88,7	258	195	51,6
22 сентября	«Космос-1409»	11 ч 49 мин	39 340	613	62,8
24 сентября	«Космос-1410»	116	1522	1500	82,6
30 сентября	«Космос-1411»	90,1	384	208	72,9
2 октября	«Космос-1412»	89,6	280	255	65,0
12 октября (20)	«Космос-1413» — «Космос-1415»	11 ч 13 мин	19 100		64,8
14 октября	«Космос-1416»	90,2	380	217	70,4
19 октября	«Космос-1417»	104,9	1023	978	83
20 октября	«Горизонт» (21)	23 ч 57 мин	35 800		0,8
21 октября	«Космос-1418»	92,2	417	362	50,7
31 октября	«Прогресс-16»	88,7	263	193	51,6
2 ноября (22)	«Космос-1419»	89,3	290	216	70,4
11 ноября	«Космос-1420»	100,8	820	782	74
18 ноября	«Космос-1421»	89,2	286	216	70,4
18 ноября	«Искра-3» (23)	91,5	365	350	51,6
26 ноября	«Радуга» (24)	24 ч 40 мин	36 640		1,3
3 декабря (25)	«Космос-1422»	89	314	208	73
8 декабря	«Космос-1423»	94,3	575	401	62,8
15 декабря	«Метеор-2»	102	904	836	81,3
16 декабря	«Космос-1424»	89,7	371	179,4	64,9
23 декабря	«Космос-1425»	90,3	374	237	70
28 декабря	«Космос-1426»	90	377	209	50,6
29 декабря	«Космос-1427»	94	494	460	65,8

Key:
1. Launch date
2. Spacecraft
3. Initial period of orbit, min
4. Orbit height
5. Apogee, km
6. Perigee, km
7. Orbit tilt, degrees
8. June
9. Kosmos
10. Soyuz
11. hr
12. min
13. July
14. Progress
15. Molniya
16. August
17. Soyuz
18. September
19. Ekran
20. October
21. Gorizont
22. November
23. Iskra
24. Raduga
25. December

on 20 September. On 14 October the craft was separated from the complex. Its flight was completed on 16 October 1982.

The satellites "Cosmos-1413"-"Cosmos-1415" were inserted into orbit by a single launch vehicle. Their purpose is to allow debugging of the elements and apparatus of a space navigation system being created with the goal of permitting determination of the location of civil aviation aricraft and resources of the Soviet Union's merchant marine and fishing fleet.

"Iskra-3"--small artificial earth satellite similar to "Iskra-2."

"Raduga"--communication satellite with onboard retransmitting apparatus supporting continuous around-the-clock telephone and telegraph radio communication in the centimeter waveband and simultaneous transmission of color and black-and-white Central Television programs to the network of "Orbita" stations.

"Progress-16"--automatic cargo craft that delivered expendable materials and various cargo to the orbiting station. It docked with the orbiting complex on 2 November. On 13 December the cargo craft was separated, and on 14 December it terminated its flight.

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